

# The European GreenBuilding Projects Catalogue January 2006 – June 2010



**Paolo BERTOLDI**  
**JOINT RESEARCH CENTRE**

**Ana SANCHIS HUERTIS**

EUR 24645 EN

The mission of the JRC-IE is to provide support to Community policies related to both nuclear and non-nuclear energy in order to ensure sustainable, secure and efficient energy production, distribution and use.

European Commission  
Joint Research Centre  
Institute for Energy

**Contact information**

Address: Via E. Fermi, 2749, I-21027 Ispra (VA), ITALY  
E-mail: [paolo.bertoldi@ec.europa.eu](mailto:paolo.bertoldi@ec.europa.eu)  
Tel.: +39 0332 78 9299  
Fax: +39 0332 78 9992

<http://ie.jrc.ec.europa.eu/>  
<http://www.jrc.ec.europa.eu/>  
<http://re.jrc.ec.europa.eu/energyefficiency/>

**Legal Notice**

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of this publication.

***Europe Direct is a service to help you find answers  
to your questions about the European Union***

**Freephone number (\*):  
00 800 6 7 8 9 10 11**

(\*) Certain mobile telephone operators do not allow access to 00 800 numbers or these calls may be billed.

A great deal of additional information on the European Union is available on the Internet.  
It can be accessed through the Europa server <http://europa.eu/>

JRC 61879  
EUR 24645 EN  
ISBN 978-92-79-18789-6  
ISSN 1018-5593  
doi:10.2788/65492

Luxembourg: Publications Office of the European Union

© European Union, 2011

Reproduction is authorised provided the source is acknowledged

*Printed in Luxembourg*

# Introduction

*The goal of improving end-use energy efficiency and promoting the use of renewable energy sources is a key component of the EU energy and climate change policies, shared by all EU Member States. The European Commission Directorate General Energy contributes to this goal through a series of actions under the "Intelligent Energy - Europe" Programme. Given the large share of energy consumption in buildings and the large cost effective energy saving potential, special attention has been dedicated to the building sector. To this end a major step forward is represented by the Directive 2002/91/EC on the Energy Performance of Buildings and the Recast of the EPBD 2010/31/EU.*

*The GreenBuilding Programme (launched in January 2005) is one of these actions, aimed specifically at improving energy efficiency in private and public non-residential buildings.*

*The GreenBuilding Programme is a European Commission voluntary programme through which non-residential building owners and occupiers, being private or public organisations, are aided in improving the energy efficiency and to introduce renewable energy sources into their building stock. Any enterprise, company or organisation (hereinafter defined as "organisation") planning to contribute to the GreenBuilding Programme objectives can participate.*

*This document describes some of the projects implemented by GreenBuilding Partners in the period 2005 to June 2010. The projects have been implemented in different types of buildings, such as office buildings, schools, hotels, hospitals, shopping mall, etc. Both new construction and the refurbishment of existing buildings are covered by the report.*

*Additional information on the goals and results of the GreenBuilding Programme, as well as the current Partners' list and the list of the National Contact Points can be found in the GreenBuilding Programme website at:*

*<http://re.jrc.ec.europa.eu/energyefficiency/greenbuilding/index.htm>*

*Paolo Bertoldi*



# Index of Projects

AB Vasilopoulos S.A. ....	1
Agios Dimitrios .....	1
AFA Försäkringsaktiebolag .....	2
Gråmunkholmen 4 .....	2
AHB Immobilien GmbH & Co. ....	3
IAG Büro- Gewerbegebäude.....	3
Akademie Deutscher Genossenschaften ADG e.V .....	4
Schloss Montabaur Tabor.....	4
Schloss Montabaur Humbach .....	4
Akademiska hus Norr.....	5
Naturvetarhuset LU1-LU3 .....	5
Aktor S.A. ....	6
Central office building.....	6
Albert-Ludwig-Universität Freiburg .....	7
Kollegiengebäude III .....	7
Allianz Elementar Vers. AG.....	8
Office Building .....	8
Almdudler A. & S. Klein GmbH & Co KG .....	9
Almdudler Bürohaus Wien 19 .....	9
AMF Fastigheter .....	10
Pelarbacken mindre 23.....	10
Amt der NÖ Landesregierung.....	11
Business center Lower Austria .....	11
Amt Ortrand .....	12
NAW-Grundschulgebäude .....	12
Área Hospitalaria Juan Ramón Jimenéz de Huelva .....	13
Hospital Juan Ramón Jimenez .....	13
Hospital Vázquez Díaz .....	14





Centro Virgen de la Cinta .....	15
Areim .....	16
Torkhuset 4.....	16
Ärzteversorgung Niedersachsen .....	17
Gutenberghof.....	17
Aspholmen Fastigheter AB.....	18
Boländerna 30:2.....	18
Gjutjärnet 7 .....	19
Virkeshandlaren 10 .....	20
Athens International Airport.....	21
Athens Int. Airport .....	21
Banco de Sabadell S.A.....	22
Documentation Warehouse .....	22
Bank of America.....	23
Bank of America .....	23
BAU-schwede GmbH.....	24
BAU-schwede .....	24
Bayer SA-NV .....	25
Kantoorgebouw Bayer.....	25
Beeline Logistikimmobilien GmbH.....	26
Logistikzentrum Beeline .....	26
Bezirksamt Charlottenburg-Wilmersdorf.....	27
Grunewald Grundschule .....	27
Herder-Oberschule .....	27
Bezirksamt Treptow-Köpenick von Berlin .....	28
Grünauer Schule.....	28
Bezirksamt Steglitz-Zehlendorf .....	29
Kita Rehazentrum .....	29
Nord-Grundschule .....	30
Billa AG-Penny Department .....	31
Supermarket Klosterneuburg .....	31

Penny Supermarket Feistritz.....	32
BIM Berliner Immobilienmanagement GmbH .....	33
Rotes Rathaus - Tower Hall .....	33
Binario S.p.A.....	34
Complesso Binario.....	34
Bohinj Vodni Park d.o.o.....	35
Bohinj Vodni Park.....	35
Britalar Investimentos SA .....	36
Hospital Privado Braga.....	36
BUND Landesverband Bremen e.V.....	37
Office Building in Bremen .....	37
Burco .....	38
The Platinum .....	38
Burghauptmannschaft Österreich.....	39
Wiener Augarten.....	39
Cacém Polis.....	40
Jardim de Infância Popular .....	40
Camara Municipal de Lisboa.....	41
Piscina Municipal de Restelo.....	41
P. M. do Vale do Fundão .....	41
P. M. de Santa Maria dos Olivais .....	42
Piscina Municipal de Alvito .....	42
Piscina Municipal de Sete Rios.....	43
Capital Ship Management Corp.....	44
3, Iassonos St.....	44
Chalmersfastigheter AB .....	45
Kuggen .....	45
Vasa Hus 5.....	45
Najaden N5 .....	46
Tessin N.....	46
Vasa Hus 7.....	47
City of Erlangen .....	48

Kinderhaus Eltersdorf.....	48
City of Labin.....	49
MRB Kature Labin.....	49
City of Regensburg.....	50
Goethe Gymnasium .....	50
City of Sonthofen .....	51
Gymnasium Sonthofen .....	51
City of Wertheim.....	52
Comenius Realschule.....	52
CKG Betlehem .....	53
CKG Betlehem .....	53
Club Natació Sabadell CNS.....	54
Can Llong.....	54
Commerzbank AG.....	55
Silvertower .....	55
Companhia Carris de Ferro de Lisboa s.a. ....	56
Edifício A Complexo Miraflores.....	56
Comune di Cologno Monzese .....	57
Polo territoriale prima infanzia con asilo nido.....	57
Comune di Faenza (Ra).....	58
Scuola Tolosano .....	58
Consejería de Empleo y Mujer – Com. De Madrid .....	59
Dirección General de la Mujer .....	59
Consejería de Empleo y Mujer .....	60
Contratas Y Obras.....	61
CyO New Headquarter.....	61
Coperfil Real Estate Group .....	62
Logispark Meco .....	62
Cornelsen Verlag GmbH & Co.....	63
New Publishing Building .....	63

Corpus Sireo Asset Management GmbH .....	64
Büro-und Technikkomplex .....	64
DTAG Büro-und Technikgebäude.....	64
Cosmote Mobile Telecommunications SA.....	65
Company headquarters.....	65
Operations center.....	65
<b>Council of Ultzama .....</b>	<b>66</b>
Ayuntamiento; Servicios Sociales; Centro Cívico; Centro de Salud; Frontón; Polideportivo; Piscinas municipales y Colegio comarcal.....	66
DC Commercial GmbH & Co. KG .....	68
Friedrichstraße 19 .....	68
DEGI Deutsche Gesellschaft für Immobilienfonds GmbH.....	69
WestendGate.....	69
Deka Immobilien GmbH.....	70
GAP 15 .....	70
Deloitte Düsseldorf .....	71
Spherion .....	71
Det Norske Veritas Poland Real Estate Sp zoo.....	72
DNV Building .....	72
Deutsche Lufthansa AG.....	73
Lufthansa Aviation Center .....	73
Diligentia.....	74
Dykaren 17.....	74
Dr. Robert Murjahn Institute .....	75
RMI – Türkiye .....	75
Düsseldorfer Hypothekenbank AG.....	76
Berliner Allee, 43.....	76
EcoPuur cvba .....	77
Kantoren en Magazijn .....	77
EjendomsInvest Oy Ab.....	78

Hyvinkää Home Center .....	78
Energosistemi d.o.o. ....	79
EE info corner .....	79
European Renewable Energy Council .....	80
Renewable Energy House .....	80
Evangelische Kirche Stadl Paura .....	81
Church Stadl Paura .....	81
Fa. Ing. Siegfried Manschein GmbH .....	82
Nullenergiebüro Manschein .....	82
Fabege AB .....	83
Paronet 8 .....	83
<b>Fastighets AB Brostaden .....</b>	<b>84</b>
Alphyddan 11; Domnarvet 39; Ekenäs 1, 3; Ekstubben 21, 22a, 22b; Godståget 1; Haifa 1; Hästholmen 2; Karis 3, 4; Linde Torp 8; Mästaren 1; Rensriet 25; Sicklaön 393:4, 394:5; Stensätra 7; Tidskriften 2; Tjurhornet 15; Torngluggen 1; Veddesta 2:19, 2:21, 2:22, 2:23, 2:50; Hammarby Smedby 1:454 .....	84
Fredsfors 14 .....	85
Rosersbergs chocolate warehouse .....	86
Vallonsmidet 8 .....	87
Getholmen 1 .....	88
Fastighets AB Corallen .....	89
Ödman 15 .....	89
Fastighets AB Navet .....	90
Lindholmspiren, 3 .....	90
Fastighetsaktiebolaget Bangårdsposten .....	91
Stockholm Waterfront Congress Centre .....	91
FEZ Berlin .....	92
Kinder-, Jugend- und Familienzentrum .....	92
Folksam .....	93

Tullgården 2 .....	93
Manfred 7 .....	94
Frankonia Eurobau Projektentwicklung GmbH .....	95
Sign-Hafenoffice .....	95
Friesenquartier Building FQ 22 .....	96
Fundação Calouste de Gulbenkian.....	97
Edifício Sede e Museu buildings .....	97
Fundation "Francisco Grande Covián" .....	98
Hospital del Oriente .....	98
Galären i Luleå AB .....	99
Ormen 1 .....	99
Gamla Livförsäkrings AB SEB Trygg Liv .....	100
Kv. Siktet 5, Hus 1 .....	100
Kv. Siktet 5, Hus 2 .....	100
Gavlefastigheter AB.....	101
Stadshuset.....	101
Gebrüder Immler .....	102
Passive House office building.....	102
Discount store "Takko" .....	103
GEK S.A. ....	104
New central office building .....	104
Gimnazija Bernardin Frankopan.....	105
School building .....	105
GMW Eigenbetrieb Gebäudemanagement.....	106
Grundschule Haarhausen .....	106
Greek Postal Savings Bank.....	107
Building .....	107
Grundschulverband Marktbreit.....	108
Grundschule Marktbreit.....	108
Halliburton-Tananger .....	109
Offices - Building 6S.....	109



## **Harry Sjögren AB..... 110**

Ängsviolen 1; Skinntickan 1; Generatörn 2;  
Syrgasen 8; Pottegården 4; Gaslyktan 11; Anisen  
3; Tjärblomman 3; Tulpanen 1; Tusensönan 2;  
Törnrosen 3; Vallmon 2,3,6,7; Berguven 1; Varla  
2:380, 2:388; Kungsbacka 4:47; Hede 3:127,  
3:131; Riskullaverket 2; Hönekulla 1:571;  
Kobbegården 6:180, 6:360, 6:362, 6:724, 6:726;  
Högsbo 20:22, 24:12, 27:7, 28:3, 36:9, 38:9, 40:1;  
Rud 51:21; Konfektasken 15; Stallet 3; Karsossen  
3; Flaggan 1..... 110

Havenbedrijf Gent agh..... 113

Passief kantoor..... 113

HAVI Global Logistics GmbH ..... 114

Headquarters ..... 114

HDI Errichtung und Vermietung GmbH ..... 115

Haus der Ingenieure ..... 115

HEP DP Elektra Koprivnica ..... 116

Office building ..... 116

Hernandez Cabeza Hoteles SL ..... 117

Nap Hotel..... 117

Hettich Holding GmbH & Co ..... 118

Exhibition and Office Building ..... 118

Hochtief Projektentwicklung GmbH ..... 119

Smarthouse ..... 119

Hochtief Development Austria GmbH ..... 120

Marximun ..... 120

Hofer KG ..... 121

Hofer St.Margarethen ..... 121

Hospital Virgen de las Nieves de Granada..... 122

Ámbitos Caleta y Cartuja ..... 122

Hotel am Stadtpark Hilden..... 123

Hotel am Stadtpark Hilden .....	123
Hotel ATLANTIS am Meer & Klinik Westfalen .....	124
Hotel and rehab-clinic .....	124
Hotel JAKUE.....	125
Hotel Jakue.....	125
Hotel Princess Lanassa.....	126
Hotel Princess Lanassa .....	126
Hotel Wende GmbH & Co Kg.....	127
Hotel Wende .....	127
Hoval Gesellschaft GmbH .....	128
Hoval Bürogebäude .....	128
Hufvudstaden AB .....	129
Kv Packarhuset 4 .....	129
HUK-Coburg .....	130
HUK-Coburg .....	130
Humlegården Fastigheter AB .....	131
Bremen 2 .....	131
Bremen 4 .....	132
Härden 16 .....	132
HUSÖ Fastighets AB .....	133
Astern 1 .....	133
Tingshusbacken 11:1 .....	134
Immobilienverwaltung.....	135
Hauptschule Hüttenberg .....	135
Italcementi S.p.A.....	136
Innovation & Technology Central Laboratory.....	136
Jernhusen AB .....	137
Centralstation .....	137
Kungsbrohuset .....	138
JM AB .....	139
Frösunda Park.....	139

Justizvollzugsanstalt Moabit.....	140
Penitentiary Moabit .....	140
Justizvollzugsanstalt Schwalmstadt.....	141
Penitentiary .....	141
KF Fastigheter.....	142
Bäckebo Homecenter-Huvudbyggnaden .....	142
KfW Bankengruppe .....	143
Main Office of the Federal Promotional Bank.....	143
KiK Textilien and Non-Food GmbH .....	144
Gnoien .....	144
Neuried .....	145
Mainhardt.....	145
Rennerod .....	146
Moordorf .....	146
Klinikum Freising GmbH.....	147
Klinikum Freising BA3 .....	147
Canteen kitchen & office building.....	147
KOS Grundstücksges. Hamburg GmbH & Co.KG .....	148
Neubau Bürogeb.....	148
Kölnbäder GmbH .....	149
Ossendorfbad.....	149
Komunaprojekt d.d.....	150
Vecnamenski objekt A in B.....	150
Königstein im Taunus.....	151
Haus der Begegnung.....	151
KPMG Flintholm.....	152
KPMG Flintholm .....	152
Kreis Offenbach, Der Kreisausschuss .....	153
Schul-und Bildungszentrum.....	153
Kriminalgericht Moabit .....	154
Kriminalgericht .....	154

Landesimmobiliengesellschaft Kärnten GmbH .....	155
Neues Verwaltungszentrum.....	155
Technikzentrum und Institut .....	156
Landschaftsverband Rheinland (LVR).....	157
LVR-Förderschule Louis-Braille .....	157
Landschaftsverband Westfalen-Lippe .....	158
Erich-Kästner-Schule .....	158
Regenbogenschule .....	159
Landstinget Dalarna/ Landstingsfastigheter.....	160
Avesta Lasarett .....	160
Landstingsfastigheter - Landstinget i Värmland.....	161
Hus 1 .....	161
Hus 2 .....	161
Lantmännen .....	162
HK Grodden, Hus B .....	162
La VOLA - Building.....	163
Ecoedifici .....	163
Laura Diana GmbH .....	164
Office Building VZ13 .....	164
Lemminkäinen Talo Oy Pääkaupunkiseutu.....	165
Koy Polaris Business Park Castor.....	165
Lidl Dienstleistungsgeschäft GmbH & Co. KG .....	166
Lidl Zukunftsmarkt .....	166
Magistrat der Stadt Wien.....	167
Indoor swimming hall Floridsdorf .....	167
Markt Burgebrach.....	168
Volksschule Burgebrach.....	168
Marktgemeinde Grafenstein .....	169
Primary School.....	169
MAUSS Bau Erlangen GmbH & Co. KG.....	170
Werner-von-Siemens-Strß .....	170

MEAG Munich Ergo AssetManagement GmbH .....	171
Maximilianplatz 12 .....	171
Cologne Oval Offices, no. 72 - 74 .....	172
Sonnencarree .....	173
Westgate Büro-und Geschäftsgebäude.....	174
Maria-Josepha-Str. 13-15 .....	175
Menerga d.o.o.....	176
Menerga Maribor .....	176
Merkur Warenhandels AG – Merkur Klosterneuburg.....	177
Merkur Klosterneuburg .....	177
MSF TUR.IM SGPS SA .....	178
Natura Towers.....	178
Multi Park Mönchhof GmbH .....	179
Multipark Mönchhof II - Office .....	179
Multipark Mönchhof II - Storage .....	179
Handwerkerhof – Gebäude B .....	180
Munnosal.....	181
Zentrum für ganzheitliche Medizin .....	181
Natuurpunt.....	182
Natuurpunt.....	182
NCC GmbH .....	183
NCC GmbH Office Building .....	183
<b>NCC Property Development.....</b>	<b>184</b>
NCC Property Development AB.....	185
Kaggen .....	185
Lysaker Torg 45 .....	186
Lysaker Nova .....	186
Maskrosen .....	187
COOP Kungsbacka .....	188
NCC Property Development.....	189
Company House Kolding III .....	189
Company House Vallensbæk .....	190

NCC Property Development Oy.....	191
Airport Plaza III .....	191
NH Hoteles .....	192
NH Central Convenciones.....	192
NH Podium.....	192
NH Príncipe de la Paz .....	193
Objektgesellschaft Moosacher Straße mbH& Co. KG.....	194
Olympia Office Tower .....	194
Olympia Office Tower (Campus).....	194
OPP Ørstedskolen .....	195
Public School .....	195
Osnovna škola Ivan Goran Kovačić .....	196
Existing school building .....	196
Österreichischer Gewerkschaftsbund ÖGB .....	197
Biberstraße 5 .....	197
Peab AB .....	198
Haga Vinge .....	198
Pfizer AB .....	199
Pfizer ABs office.....	199
Pharmaserv GmbH & Co. KG .....	200
M202 Green Office .....	200
Phoenix Park d.o.o .....	201
Phoenix Plaza .....	201
Piraeus Bank .....	202
Central office building.....	202
Planbo Projekt AB.....	203
Renaissance Malmö Hotel .....	203
Primary School Frankfurt/Riedberg .....	204
Primary School and Day Care Centre .....	204
Prologis AB .....	205
Arlanda DC 1.....	205



Provincia di Venezia.....	206
I.T.I.S. "C. Zuccante" (administrative block)...	206
Rehabilitationszentrum Althofen.....	207
Humanomed Centre .....	207
Rehau AG+CO .....	208
GeothermiePark Y .....	208
RheinEnergie AG.....	209
Neubau Hauptverwaltung Gebäude 11 .....	209
Neubau Hauptverwaltung Gebäude 12 .....	210
Neubau Hauptverwaltung Gebäude 13 .....	210
Neubau Hauptverwaltung Gebäude 14 .....	211
Neubau Hauptverwaltung Gebäude 15 .....	211
Rondo Property Investments Sp. z o.o .....	212
Rondo ONZ 1, Pl-00-124 .....	212
Schwab Versand GmbH.....	213
Logistikzentrum/myToys Langenselbold.....	213
Schulverband Hengersberg.....	214
Hauptschule "Abt Bernhard Hilz" .....	214
SeaBridge SA .....	215
SeaBridge Logistics .....	215
Servei Catala de la Salut.....	216
Centre d'Atenció Primària.....	216
Siemens AG - Siemens Real Estate .....	217
Halle 8+9 .....	217
Transformator Production Site .....	218
FFM CB Extension – logistics .....	219
FFM CB Ext. – production .....	219
P. Generation Schwerlasthalle.....	220
P. Generation Mittellasthalle 81 .....	221
Power Generation Bld. 60 .....	222
Kinderfest im Rötelpark .....	223
Kita Kinderlaube .....	223
Kita SieKids.....	224
Kita Karlsruhe .....	224

Amberg A & D Kantine .....	225
Siemens Mitarbeiter Casino.....	225
München Perlach, Gebäude 9115.....	226
1749 Hofmannstraße 5.....	227
1748, 1754, 1755 Hofmannstraße 51 .....	227
Test Center: Prüffeld Nord.....	228
Power Generation Office Bld. 91.....	228
Lindenplatz 2.....	229
Office Building 82, BA1.....	230
Verwaltungsgebäude Berlin .....	231
Düsseldorf-Airport .....	232
<b>Siemens AG Österreich .....</b>	<b>233</b>
Siemens City .....	233
<b>Siemens Transmission et Distribution .....</b>	<b>234</b>
Grenoble: Building C3 .....	234
<b>Siemens S.p.A. ....</b>	<b>235</b>
Vipiteno Office Building 1 - 2 .....	235
Roma Lauretina.....	235
<b>Sjælsø A/S Danmark.....</b>	<b>236</b>
Kopenhagen Towers B 408 .....	236
Kopenhagen Towers B 409 .....	236
<b>Skanska Commercial Develop. Nordic 237</b>	
Gårda 18:25 .....	238
Scylla 3 .....	239
Sturegatan 1 .....	240
Hagaporten 3 .....	240
Österport 7 .....	241
<b>Skanska Property Czech Republic s.r.o. ....</b>	<b>242</b>
Skanska Nordica .....	242
<b>Skanska Property Hungary Kft.....</b>	<b>243</b>
Népliget Center .....	243
<b>Skanska Commercial Development Finland oy .....</b>	<b>244</b>
Lintulahti Office .....	244
<b>Skanska Øresund A/S.....</b>	<b>245</b>



Alfa .....	245
Havneholmen Tower .....	246
BCG48.....	247
Skanska Property Poland.....	248
Atrium City.....	248
Grunwaldzki Center Building A.....	249
Grunwaldzki Center Building B.....	250
Grunwaldzki Center Building C.....	250
Marynarska Point B1 and B2 .....	251
Solux GmbH.....	252
Solux GmbH.....	252
Sparkasse Herford .....	253
Sparkasse Herford, Altbau .....	253
Sparkasse Herford .....	254
Sparkasse Vorderpfalz .....	255
Ludwigshafen .....	255
Srednja škola/High school Duga Resa.....	256
High school .....	256
Stadt Mörfelden-Walldorf.....	257
City Hall Walldorf.....	257
Burgerhaus.....	258
Stadt Nuernberg.....	259
Kindertagesstätte .....	259
Stadt Oldenburg.....	260
Vocational School Haarentor .....	260
Statens Fastighetsverk.....	261
Stockholms Observatorium.....	261
Svartsjö/Färingsö .....	262
Carlstens fästning.....	263
Stebo vzw.....	264
Homepage .....	264
Stephan Terbrack GmbH.....	265
Neubau - Produktion .....	265

Strömberg Distribution Fastighets AB.....	266
Jordbromalm 4:10 .....	266
Svenska Kyrkan i Göteborg.....	267
Bergums Kyrka.....	267
Billdals Kyrka.....	268
Västra Frölundas Kyrka.....	269
TechnologieCenter Eching GmbH.....	270
Handwerkerhof Eching.....	270
TEDI GmbH.....	271
TEDI Moordorf FM 01 .....	271
TEDI Mainhardt FM 02 .....	271
Telge Fastigheter.....	272
Ljungbacken Förskola.....	272
Kaxberg Förskola.....	272
Hölö Förskola .....	273
Tengelmann Warenhandelsgesellschaft KG.....	274
Tengelmann Klimamarkt .....	274
Terme snovik.....	275
Terme Snovik .....	275
TGE SpA.....	276
Historical Building .....	276
THS GmbH.....	277
Hauptverwaltungsgebäude Nordstern.....	277
Trigranit Development Corporation .....	278
Millenium Tower I .....	278
UniCredit RealEstate SpA .....	279
San Elia .....	279
Union Investment Institutional Property GmbH.....	280
Bürohochhaus Hahnstraße .....	280
Uniqua Immobilien Service GmbH .....	281
UNIQUA Tower .....	281

University of Arts in Berlin .....	282
Universität der Künste.....	282
University of Split.....	283
Library .....	283
Uppsala kommun .....	284
Årsta 59:1.....	284
Valamar turistički projekti d.o.o.....	285
Autocamp Politin .....	285
Vasakronan AB .....	286
Hekla hus 10 .....	286
Spektern 13 B .....	287
Riga 2 .....	288
Kista Science Tower .....	289
Pennfaktaren 11.....	290
Kv Skjutsgossen 8 .....	291
Tingsrätten Ullevi Park.....	292
Ullevifastigheter AB .....	293
Vastfastigheter.....	294
Tehuset .....	294
Videum AB.....	295
Hus N.....	295
Vimusa.....	296
Alexandra Building .....	296
Viroc Portugal .....	297
Viroc Headquarters .....	297
V-Port Real Estate AB.....	298
Västerport in Stockholm.....	298
VZW Rotonde .....	299
Centrale campus Augustijnslei .....	299
Huize Goeyers.....	299
Wallfast AB.....	300
Havsfrun 26 .....	300

Weisenburger Kita Halle Gmbh .....	301
Kindertagesstätte Reggio “Kleiner Raabe” .....	301
Kindertagesstätte Taubenhaus .....	301
Wihlborgs Fastigheter AB .....	302
Dockum .....	302
WWFF Business and Service Center GmbH .....	303
Energy Base building .....	303
YIT Construction Ltd. ....	304
Avia Line II .....	304
Zeolit Exploaterings AB / Faberge AB .....	305
Paradiset 29 .....	305
ZIAG Immobilien AG .....	306
Stadtfenster Dortmund .....	306
<b>Contact .....</b>	<b>307</b>







## **Agios Dimitrios**

*Komninon 1 Ethnomartiron & Anagenniseos, Agios  
Dimitrios, Athens, Greece*

For this supermarket, energy savings are achieved by implementing a variety of measures such as:

Cover the freezers with glasses; Production of hot water from heat of refrigeration system; Use of T5 lamps type and electronic ballasts; Control of store lighting (zones) with time schedules; Controlled operation of escalators and installation of motion sensors; Use of electrical elevator with inverter without machinery room; Electronic expansion valves in refrigerators; Motorized curtains at self service refrigerators; EC fans to cabinets of refrigerators; Air conditioning control system; Installation of double curtain in extraction hood, sensors for controlling parking fans operation based on the level of pollutant gases (as CO) and use of time schedule for rest ventilation operation; Reduce lighting from the shelves of refrigerators and cosmetics. Utilization of natural lighting using lighting sensors. Override operation mode of electric heaters of air curtains during the summer period.



**New - 2010**

*Type of building:*

**Commercial**

*Area:*

**4.531 m<sup>2</sup>**

*Reference value:*

**237,24 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**161,32 kWh/m<sup>2</sup>yr**

*Energy savings:*

**32%**

*Investment:*

**90.000 €**

*Annual savings:*

**34.300 €/yr**



## Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**8.029 m<sup>2</sup>**

*Before refurbishment:*

**264,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**163,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**38%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Gråmunkholmen 4

*106 27 Stockholm, Sweden*

The building, almost entirely consisting of office, was constructed 1882-1889 and rebuilt in 1992- 1994. The house has modern ventilation with heat recovery ventilation and heated by district heating.

Extensive measures are planned in the building. In all, it is estimated that 928 MWh/year will be saved.

This will be done by a wide variety of measures such as uptime optimization of air handling units, reconstruction of the cooling system for improved heat pump operation and replacing the entire control- and monitoring system.

## IAG Büro- Gewerbegebäude

*Friedrichshofener Straße 1, 85049, Ingolstadt,  
Germany*

The new commercial building is located in a business park on the outskirts of Ingolstadt. The building shall provide high quality areas for offices and retail stores and joins this with ambitious aims regarding energy saving. Energy savings are achieved mainly by an improved building envelope and the use of renewable energy sources. Triple pane glazing and thermal well insulated mullions are used within the curtain wall façade. Motor driven exterior sun screens avoid overheating in summer efficiently.

Basic heating and cooling is provided by thermoactive ceilings (TABS) in the offices. The heat is generated by geothermal heat pumps. The peak load is covered by a district heating system with a high proportion of cogeneration and renewable energy. In summer the geothermal system is used to cool the building structure by the TABS.

During times with high cooling loads, the heat pump can be operated in reverse mode, providing additional cooling energy. Mechanical ventilations systems with high efficient heat recovery devices are used to reduce ventilation heat losses. To keep up energy efficiency of the systems, maintenance is organised in the long term and a guideline for the efficient operation is prepared by the planner .



### **New - 2010**

*Type of building:*

**Office**

*Area:*

**8.929 m<sup>2</sup>**

*Reference value:*

**200,10 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**132,03 kWh/m<sup>2</sup>yr**

*Energy savings:*

**34%**

*Investment:*

**149.080 €**

*Annual savings:*

**n/a**



## Refurbishment - 2009

*Type of building:*

**Hotel**

*Area:*

**3.584 m<sup>2</sup>**

**2.569 m<sup>2</sup>**

*Before refurbishment:*

**280,92 kWh/m<sup>2</sup>yr**

**531,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**194,16 kWh/m<sup>2</sup>yr**

**238,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**30%**

**55%**

*Investment:*

**602.941 €**

**602.941 €**

*Annual savings:*

**n/a**

## Schloss Montabaur Tabor

*56410, Montabaur, Germany*

## Schloss Montabaur Humbach

*56410, Montabaur, Germany*

House Tabor is one of the main buildings inside of the property. It's in use as seminar rooms, auditorium, swimming pool, sauna, fitness room, bowling alley and building equipment.

House Humbach is a central building inside of the property. It's in use as dining-hall (3 x), kitchen, bar, internet-cafe, seminar rooms, library, apartments and building equipment.

The interventions are renovation of the heating, ventilation, airconditioning-system and the illumination.





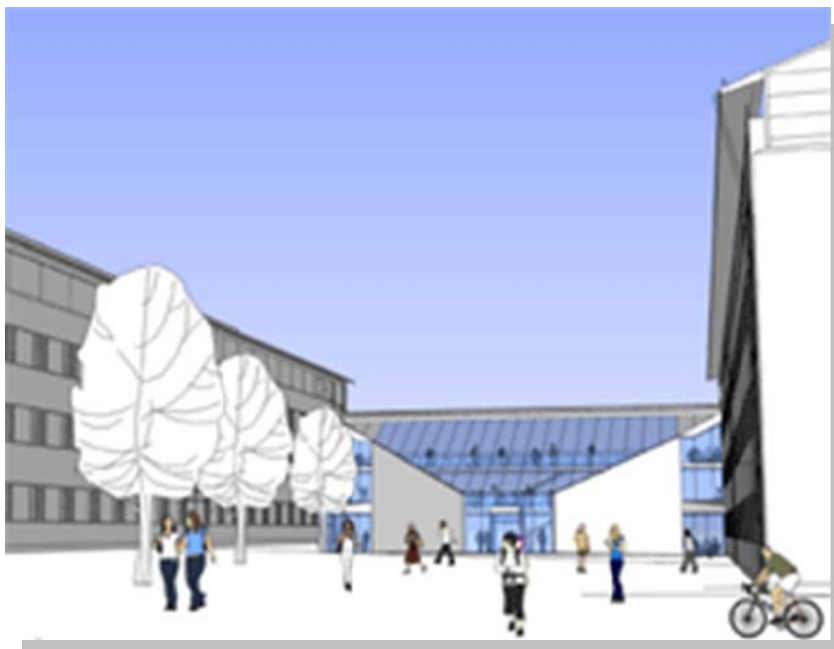
## Naturvetarhuset LU1-LU3

*Umeå, Sweden*

In the main office building Naturvetarhuset at Umeå University, Akademiska Hus has been able to reduce the energy consumption by some 60 %. This has been accomplished by for example installing new demand-controlled ventilation and lighting installations.

Akademiska Hus has been working towards reduced energy consumption in its facilities for many years. The company is also co-operating with the Swedish Energy Agency and other large owners of commercial facilities in a national project called Bygga-bo-dialogen.

Akademiska Hus is also one of the main actors in developing and commercializing new energy-efficient installations through the participation in BELOK.



### Refurbishment - 2007

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**126,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**46,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**63%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2007**

*Type of building:*

**Office**

*Area:*

**23.425 m<sup>2</sup>**

*Reference value:*

**200,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**158,33 kWh/m<sup>2</sup>yr.**

*Energy savings:*

**21%**

*Investment:*

**585.000 €**

*Annual savings:*

**98.670 €/yr**

## Central office building

*15th KM of National Road Athens, Lamia, Greece*

For this office building, energy savings are achieved mainly by implementing a variety of measures such as:

Very high efficiency water cooled chillers with EER ranging between 5,75 @100% load and 8,35 @ 50% load.

Using T5 lamps and electronic ballasts.

Pumps with full inverter control.

System for measuring the quality of air in the underground parking. It will control fans operation based on the level of pollutant gases (as CO), also use of inverter fans and BMS controlling the operation of HVAC, façade shading, etc.

Building envelope: Atrium: Total area of 200 m<sup>2</sup>, in the central building zone: for daylight penetration in the adjacent office zones; for improved thermal performance of the building. Further thermal protection provided by printed glass panes (60% of tot glass area); Shading devices: Vertical glazing on south, east and west windows are protected by external aluminium horizontal movable louvers. The system is automatically controlled by the Building Energy Management System; Vertical facades: Low-e glass, Double panes, low U-values, high light transmittance and high Shading coefficient.







## Kollegiengebäude III

*Platz der Universität 3, 79098, Freiburg, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as: Installation of pumps with speed regulation; Demand-oriented pumps; Hydraulic adjustment of the heating system and closure of hydraulic bypasses.

Also the removal of the 13 RLT-constructions; Installation of three new main-RLT-constructions with speedregulated ventilation to supply four or five zones; The 13 zones will be equipped with volume control loops and downstream heat exchangers; Demand-orientation of the air supply and outlet air; Installation of additional sensitive elements and optimisation of zone regulation.

Installation of consumption meters (in all buildings): Complete renewal of RLT-control by new control boxes, performance parts and new DCCs; Expansion of central building control systems, circuit-entering of all relevant data points.

Continuous energy consumption recording; Consumption control, analysis and processing of data, determination of tendencies; Energy report with information to the development of energy consumption and savings



### Refurbishment

*Type of building:*

**Educational**

*Area:*

**25.000 m<sup>2</sup>**

*Before refurbishment:*

**102,84 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**70,44 kWh/m<sup>2</sup>yr.**

*Energy savings:*

**31,5%**

*Investment:*

**409.403 €**

*Annual savings:*

**51.055 €/yr**



## Refurbishment - 2006

*Type of building:*

**Office**

*Area:*

**37.614 m<sup>2</sup>**

*Before refurbishment:*

**Heat: 116,85 kWh/m<sup>2</sup>yr**

**Elec.: 159,42 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**Heat: 86,38 kWh/m<sup>2</sup>yr**

**Elec.: 113,97 kWh/m<sup>2</sup>yr**

*Energy savings:*

**26% (heat)**

**16% (elec.)**

*Investment:*

**840.000 €**

*Annual savings:*

**Gas: 65.383 €/yr**

**Electricity: 70.936 €/yr**

## Office Building

*Hietzinger Kai 101-105, 1130, Vienna, Austria*

Modernization of heating system: boiler house on the 11th floor has been fully gutted. Replacement of 2 boilers and 1 binary boiler (Dualkessel) to 3 condensing boilers. Outside of the building a gas regulation station is situated.

The majority of the pneumatic control system, which was in use since the erection of the building, was replaced in 2005 and 2006 by a new control system with a central building control system (a product of the new generation).

Office equipment: All places of work within the office building were equipped with flat screens in 2007. For this reason, apart from aspects of health also a reduction of the heat development and therefore an improvement of the room climate was achieved.

Illumination: all electrical floor distributors were completely renewed. It is planned to optimise the artificial light supply of places of work in the office buildings which is carried out at present by pendant fitting with separate adjustable direct and indirect lighting by means of a central switching control.

Cooling: The air washers were completely renewed in 2006. In 2007 and 2008 the heating and radiator grill of the 3 large air conditioners of the house were exchanged. They are used separately for the interior and outer zones of the office building.





## Almdudler Bürohaus Wien 19

*Grinzing Allee 16, 1190, Vienna, Austria*

For the new office building natural raw materials have been used as far as possible. For the facade an insulation system using rock wool has been chosen. The top floor consists of massive wood. For the interior fitting fibre reinforced plasterboards have been used. The building is heated with a reversible brine/water heat pump with a heating capacity of 55.5 kW and a cooling capacity of 41.7 kW. For this system 11 depth drillings of 150 m have been applied. These deep drillings are also used in summer as a heat rejection system. Because of the glazed atrium daylight is available in the whole building which minimizes the need for electrical lighting. Ventilation is available for meeting rooms and public spaces.

The atrium is ventilated with automatically controlled dampers. Heat is distributed via massive core activation for the base load and radiators as well as floor heating for peak loads. All heating systems can be controlled for each room separately. Cooling is also provided by massive core activation. The atrium is cooled by natural ventilation during the nighttime.



**New - 2009**

*Type of building:*

**Office**

*Area:*

**1.040 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**>25%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2009

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**169,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**80,00 mWh/m<sup>2</sup>yr**

*Energy savings:*

**53%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Pelarbacken mindre 23

*Sweden*

The renovation project will be extensive and most technical equipment as well as inside structures will be replaced. The renovation aims at a simple, functional and easily managed solution.

The using of heating and cooling will be drastically reduced by replacing the ventilation system.

The building's own ability to store heat and cool will be used.

Recycling will be used. A LAC (low amplitude control) will be used to foresee the need for heating and cooling. Transmission losses will be reduced by exchanging all windows.

The usage of warm water will be reduced by using special mixers. The energy used for heating water is however very small compared to the energy used for heating and electricity.

AMF has a very well developed energy management system with monthly follow ups and an advance computer system that indicates when buildings use more energy than expected.







## Business center Lower Austria

*Niederösterreichring 2, 3109, St. Pölten, Austria*

The concept for the building envelope and services follows the passive house concept. Measures include a high insulated building envelope, high air density, avoidance of thermal bridges, mechanical ventilation system, heating and cooling via massive core activation and renewable energy.

Building envelope: 30 - 40 cm insulation of walls, roof and cellar ceiling, reduction of thermal bridges (e.g. optimisation of the installation of the windows), use of highly efficient windows, high air density.

Heating: is provided by a central water/water heat pump using the river Traisen as an energy source. The heat is distributed through activation of thermal masses. Fresh air for the ventilation system is first heated through the heat exchanger from the heat recovery system, the remaining heating demand is covered by the heat pump.

Cooling: because of the high quality of the building envelope, the moderate portion of windows and the external shading system, the cooling demand is rather low. The cooling demand is covered by free cooling using the ground water. Cooling is distributed through activation of thermal masses. In areas with a higher cooling demand (meeting and server rooms) there are additional radiant ceiling panels. Fresh air is cooled by a conventional chiller.

Lighting: Daylight is used in favour, light controlling blinds have been installed. Artificial lighting is controlled by presence sensors and sensors for natural light.



**New - 2007**

*Type of building:*

**Office**

*Area:*

**7.735 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**>25%**

*Investment:*

**17.000.000 €**

*Annual savings:*

**150.000 €/yr**



## Refurbishment - 2009

*Type of building:*

**Educational**

*Area:*

**250 m<sup>2</sup>**

*Before refurbishment:*

**640,10 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**130,30 kWh/m<sup>2</sup>yr**

*Energy savings:*

**79,6%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## NAW-Grundschulgebäude

*Schulstraße 36, 01990 Ortrand, Germany*

For this building, energy savings are achieved by implementing a variety of measures such as:

Building envelope: Exterior Walls: 10 cm expanded Polystyrene,  $U = 0,26 \text{ W/m}^2\text{K}$ ,  $WLG = 0,032$ ; Basement: 10 cm expanded Polystyrene,  $U = 0,230 \text{ W/m}^2\text{K}$ ,  $WLG = 0,035$ ; Roof: 20 cm cellulose,  $U = 0,210 \text{ W/m}^2\text{K}$ ,  $WLG = 0,040$ ; Windows: Synthetic Frame,  $U = 1,4 \text{ W/m}^2\text{K}$ .

Heating: Natural gas heating value, rated power 20 kW, system temperature 55/45, hydraulic adjustment.

Ventilation system combined with heat recovery, centralised, heat recovery rate of 90%.

Lighting: fluorescent lamps, Output: 13,4 kWh/m<sup>2</sup>a.



Hofansicht NAW -Gebäude



## Hospital Juan Ramón Jimenez

*Huelva, Spain*

The total savings achieved from cold production system refurbishment and the replacement of lamps with low-consumption lights, are a significant part of the total electrical consumption.

The highest proportion of natural gas is destined to the heating system but the solar system installation here only affects sanitary hot water production, so the percentage of fuel savings provided by the solar system is low in relation to the total fuel consumption. Total consumption of fuel: 17.209.990 KWh/yr natural gas. Saving in fuel: 691.895,99 KWh/yr (4 %).



### Refurbishment - 2007

*Type of building:*

#### Health

*Area:*

**70.249 m<sup>2</sup>**

*Before refurbishment:*

**196,43 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**125,52 kWh/m<sup>2</sup>yr**

*Energy savings:*

**36%**

*Investment:*

**1.883.850 €**

*Annual savings:*

**395.969 €/yr**



## Refurbishment - 2007

*Type of building:*

**Health**

*Area:*

**15.200 m<sup>2</sup>**

*Before refurbishment:*

**113,16 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**29,86 kWh/m<sup>2</sup>yr**

*Energy savings:*

**73,6%**

*Investment:*

**115.000 €**

*Annual savings:*

**52.576 €/yr**

## Hospital Vázquez Díaz

*Huelva, Spain*

In this centre, the saving is based on the total removal of gas-oil consumption in the boilers. Instead, natural gas is used, so we must take into account the CO<sub>2</sub> emissions that this type of gas produces. Nonetheless, emissions are fewer, because it is a cleaner fuel. Therefore, from the environmental perspective, the reform turns out to be successful and positive.

On the other hand, the use of renewable energy is fostered thanks to the thermal solar energy system for the production of sanitary hot water, together with the saving of 104.049,40 KWh/year in natural gas.







## Centro Virgen de la Cinta

*Huelva, Spain*

The global reform of the climatization system by means of the installation of an integral system of heat/cold production will considerably elevate the yearly consumption of the centre, given that, in contrast with the previous system, it is going to give coverage to all the centre facilities.

Equally, the use of gas-oil is to be eliminated. Nevertheless, the energetic balance of CO<sub>2</sub> emissions will be positive, without forgetting about the user's comfort.

The renovation of the lighting system entails a 20.9% saving of the current consumption of electrical energy in the centre.



### Refurbishment - 2007

*Type of building:*

**Health**

*Area:*

**3.862 m<sup>2</sup>**

*Before refurbishment:*

**66,12 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**54,66 kWh/m<sup>2</sup>yr**

*Energy savings:*

**20,9%**

*Investment:*

**872.790 €**

*Annual savings:*

**312.938 €/yr**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**n/a**

*Reference value:*

**102,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**71,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**31%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Torkhuset 4

*Hammarby Sjöstad, Stockholm, Sweden*

To obtain the criteria for GreenBuilding partnership, the following is included in the building project:

Presence control lighting and regulation of the light from the armature in relation to the daylight, so that the average light is 300 lux.

Nightcooling take place with increased operation in daytime and we make use of recycling of cooling under the warm months. "Free cooling"/"Recycling of Heating" is achieved between cooling system and the ventilation system. Using "used air" from the office for ventilation of the parkingspace.

Using building material and glas with low U-values.

A solar energy system is installed (produces approx 20,6 MWh)

Central heating and district cooling is used.

AREIMs energy management system is based on goal and action plans set for energy as a part of the yearly budget process. Meters for energy consumption are read every month and the data is presented in a web based system, Webbess. Follow up is made every quarter with comments on the statistic data.



## Gutenberghof

*Berliner Allee 7-9, 30175 Hannover, Germany*

For this office building, energy savings are achieved by implementing a variety of measures such as:

Heat supply from district heating system, system temperature of 70/40 °C (dynamic), radiators fit up with electric actuator, centralized return distribution.

Use of summerly district heating for production of cooling by absorption and refrigerating machine compression-type refrigeration machine, cooling ceiling system.

Centralized ventilation system with volume flow regulator, regenerative heat recovery used as circulating heat ex-changer and power adjustment via rotation speed control.

Lighting according to EN 12464 and DIN 5035.

Building envelope: Exterior Walls:  $U = 0,35 \text{ W/m}^2\text{K}$  (wood & stone) Windows: composite window with wooden & aluminum frame  $U=1,1 \text{ W/m}^2\text{K}$ .



**New - 2010**

*Type of building:*

**Office**

*Area:*

**8.512 m<sup>2</sup>**

*Reference value:*

**307,23 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**222,44 kWh/m<sup>2</sup>yr**

*Energy savings:*

**27,6%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2008

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**104,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**46,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**55,8%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Boländerna 30:2

*Örebro, Sweden*

We installed geothermal heating and cooling. The construction consists of 6 drill holes. In and from the holes houses connect to the heat-pump. The real estate is also connected to the district heating system to clear peak heating needs in winter.

The geothermal construction is dimensioned to fullfill 90 % of cool water needs and remaining needs are produced by the heat-pump. For heating the heat-pump accounts for 80 % of the heating needs and remaining needs comes from the district heating system.

Aspholmens environmental goals for the period of year 2007 - 2009 aim for energy reduction of 9 %, oil heating phase-out and conclusion of the real states environmental status. Aspholmen has been working with energy optimisation and energy conservation for a long time.





## Gjutjärnet 7

Örebro, Sweden

For this office building, energy savings are achieved by implementing a variety of measures such as:

Replacement of old cooling-machines; installation of new automatic control equipments and optimization of heat curve chart and operating times, measures to get rid of heat leakage in the façade and installation of lighting with presence-control.



### Refurbishment - 2008

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**180,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**130,80 kWh/m<sup>2</sup>yr**

*Energy savings:*

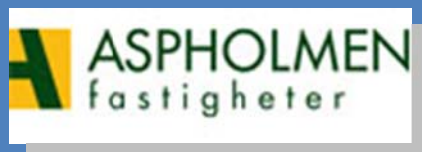
**27,4%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2008

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**104,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**56,90 kWh/m<sup>2</sup>yr**

*Energy savings:*

**45,3%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Virkeshandlaren 10

*Örebro, Sweden*

Built in year 2001 and 2002, at that time we installed geothermal heating and cooling. The construction consists of 12 drill holes. In and from the holes hoses connects to the heat-pump. The real estate is also connected to the district heating system to clear peak heating needs in winter.

The geothermal construction is dimensioned to clear 90 % of cool water needs and remaining needs are produced by the heat-pump. For heating the heat-pump accounts for 80 % of the heating needs and remaining needs comes from the district heating system.

Aspholmens environmental goals for the period of year 2007 - 2009 aim for energy reduction of 9 %, oil heating phase-out and conclusion of the real states environmental status. Aspholmen has been working with energy optimisation and energy conservation for a long time.





## Athens Int. Airport

*EL. Venizelos, Athens, Greece*

Energy Efficiency measures implemented in six different main buildings:

Ventilation and chillers time schedule and routines reengineering – BMS optimisation in 6 buildings.

Heating and cooling set points revision.

Heat recover from the MTB's chillers in order to produce hot water without burning natural gas.



### Refurbishment

*Type of building:*

**Office**

*Area:*

**36.400 m<sup>2</sup>**

*Before refurbishment:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**103 kWh/m<sup>2</sup>yr**

*Investment:*

**n/a**

*Annual savings:*

**225.440 €/yr**



**New - 2008**

*Type of building:*

**Industrial**

*Area:*

**12.046 m<sup>2</sup>**

*Reference value:*

**114,34 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**49,51 kWh/m<sup>2</sup>yr**

*Energy savings:*

**56,7%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Documentation Warehouse

*Sector "C" industrial del Llevant, Polinya, Spain*

Consumption for lighting represents almost 90% over the total energy consumed by the building. To reduce electricity consumption for lighting in the new building, measures will be implemented for better use of natural light.

Increase the percentage of ventilation and skylights in the roof of the building. The percentage of openings on the deck of the new building will be 9% instead of 5% of the conventional building.

The use of materials for the skylights and roof windows with a light transmittance, but higher than in the reference, was 20%, to get more natural light into the building.

Implementing a lighting control system by photosensors. The software used for simulation lets you control the electric lighting in accordance with the availability of natural light. The program calculates the illuminance levels of the area each interval during the simulation and then is used to determine the amount of artificial lighting that can be saved.

It is planned the establishment of a solar photovoltaic installation on the deck of the building. The annual production of the facility will be 13 982 kWh.





## Bank of America

*Croydon, United Kingdom*

Recommendations taken into account: Remember to turn off appliances and lights that do not need to be used and have some sort of shut down procedure at the end of the day; Make sure energy saving features on computer monitors, printers and photocopiers are activated; When buying new appliances, take into consideration their energy consumption rating; In centrally heated buildings, check that the heating controls time switch or programmer is set to heat the building for the minimum time required and at a minimum temperature proportionate to comfort.

Changing from existing conventional magnetic ballasts to High Frequency electronic ballasts would reduce energy consumption by approximately 20%, and greatly improve lamp life.

Recalibration of sensor devices; Recalibration of process control; Implementation of plant stand-by mode or out of occupancy shutdown if possible.

Pump Pulley alignment: Using Laser alignment equipment and software would maximise energy efficiency by up to 3%, therefore creating savings in the energy costs, it can also increase machine life and eliminate unpredicted failures, which will minimise maintenance costs and any disruptions to normal operation.

If two new correctly size boilers were to be introduced, this would optimise their operation and offer a potential of up to 95% efficiency. Due to the age of the existing equipment and the new technologies that are available in modern boilers we would estimate a minimum saving of 27.5% added savings.

The majority of AHUs are approximately 23 years old and are nearing the end of their useful life, and should be considered for replacement to new more efficient units.

### Refurbishment - 2006

*Type of building:*

**Office**

*Area:*

**13.666 m<sup>2</sup>**

*Before refurbishment:*

**Gas: 199,38 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**Gas: 141,86 kWh/m<sup>2</sup>yr**

*Energy savings:*

**40,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2006**

*Type of building:*

**Office**

*Area:*

**442 m<sup>2</sup>**

*Reference value:*

**77,81 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**44,37 kWh/m<sup>2</sup>yr**

*Energy savings:*

**43%**

*Investment:*

**575.000 €**

*Annual savings:*

**n/a**

## BAU-schwede

*Gewerbepark 13-15, 75331, Engelsbrand, Germany*

This new building is built completely in wooden frame construction with high quality insulation: Basement ceiling (U-value 0,130 W/(m<sup>2</sup>K); Exterior walls (U-value 0,185 W/(m<sup>2</sup>K); Ceiling top floor (U-value 0,106 W/(m<sup>2</sup>K); windows (U-value 1,0 W/(m<sup>2</sup>K).

Other measures: Low temperature heating with outgoing air heat pump; Controlled ventilation system with up to 90% heat recovery; Lighting system with fluorescent lamps and electronic ballasts, daylight responsive controls for outdoor lighting.

Energy management measures: responsible energy manager; monitoring of energy consumption of heat pump, ventilation, lighting and office equipment; assessment with reference to office space; employee information and motivation; reduction of stand-by losses.





## Kantoorgebouw Bayer

*J. E. Mommaertslaan 14, 1831, Diegem, Belgium*

For this office building, energy savings are achieved by implementing a variety of measures such as:

Heat production: Heat pump and condenser boiler.

Cooling production: Aquifer.

Humidification and mechanical ventilation in heated areas with heat recovery.

Lightning with FL with electronic ballasts.



**New - 2009**

*Type of building:*

**Office**

*Area:*

**6.420 m<sup>2</sup>**

*Reference value:*

**254,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**160,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**37%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Industrial**

*Area:*

**16.826 m<sup>2</sup>**

*Reference value:*

**403,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**215,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**46,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Logistikzentrum Beeline

*Dillenburgerstraße 76 51105 Köln-Kalk, Germany*

For this building, energy savings are achieved by implementing a variety of measures such as:

Heating: Selection of energy efficient products, Installation of well dimensioned heating pumps with power regulation.

Cooling: Cooling System based on water distribution with improved cooling pumps.

Lighting: Controlled lighting systems, Introduction of occupancy linking controls.

Building envelope: Installation of clear double glazed unit (6mm float+12mm air+6mm float).

Management: Recording energy consumption.





## Grunewald Grundschule

*Delbrückstraße 20a, 14193, Berlin, Germany*

## Herder-Oberschule

*Westendallee 45-46, 14052, Berlin, Germany*

For these buildings, energy savings are achieved by implementing a variety of measures such as:

Heating: New efficient pumps, adjustable thermostvents and hydraulic adjustment. Installation of modern digital systems for measurement and control. Modernisation of the heating system, installation of condensing boiler and the hot water supply.

Lighting: Complete modernisation of the lighting system with new efficient tubular fluorescent tubes.

Reduction of the ventilation power.



### Refurbishment

*Type of building:*

**Educational**

*Area:*

**6.644 m<sup>2</sup>**

**14.400 m<sup>2</sup>**

*Before refurbishment:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**>25%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment - 2010

*Type of building:*

**Educational**

*Area:*

**n/a**

*Before refurbishment:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**39,2%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Grünauer Schule

*Walchenseestr. 40, 1252,7 Berlin, Germany*

For this building, energy savings are achieved by implementing a variety of measures such as:

Heating improvement.

Lighting improvement.

Installation of a photovoltaic plant.





## Kita Rehazentrum

*Teltower Damm 95 –123, 14163, Berlin, Germany*

The rehabilitation centre in Berlin/Steglitz-Zehlendorf includes an own day-care-centre as well as a swimming pool. Within the Energy Saving Partnership Berlin (performance contracting) the Evonik New Energies GmbH realises far-ranging energy saving measures.

The refurbishment of the Kita Rehazentrum is realised within a performance contracting in cooperation with Evonik New Energies GmbH. In 2001 the heating system was modernised. For this purpose the heating-boiler was refurbished and the hydraulic of the heating system was optimised.

Furthermore the ventilation system was modernised and a central building control system was installed, which is connected to the building control system central Berlin of the Evonik New Energies GmbH.

Moreover the water treatment equipment of the swimming pool was renewed. The energy saving is assured during the whole contract period.



### Refurbishment

*Type of building:*

**Health**

*Area:*

**10.292 m<sup>2</sup>**

*Before refurbishment:*

**239,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**179,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25,1%**

*Investment:*

**97.000 €**

*Annual savings:*

**19.700 €/yr**



## Refurbishment - 2005

*Type of building:*

**Educational**

*Area:*

**5.503 m<sup>2</sup>**

*Before refurbishment:*

**172,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**109,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**36,8%**

*Investment:*

**17.800 €**

*Annual savings:*

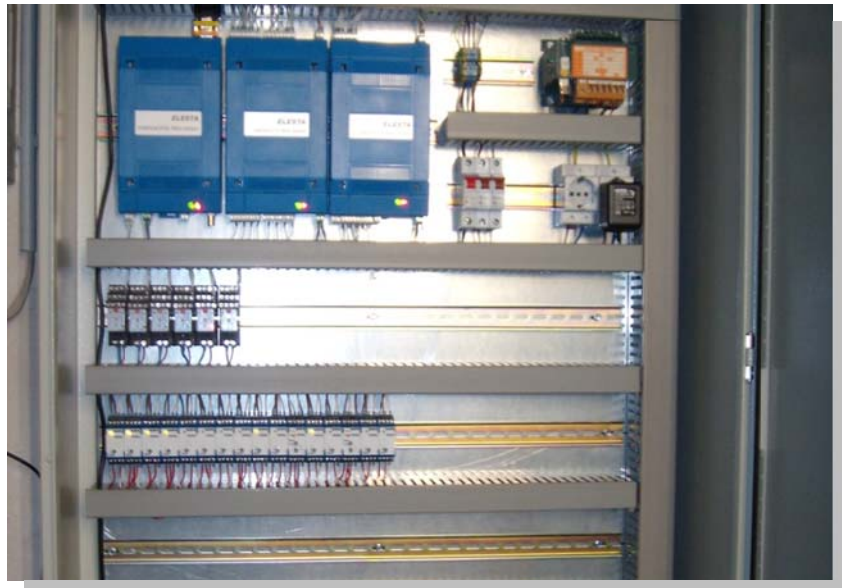
**16.500 €/yr**

## Nord-Grundschule

*Potsdamer Str. 7, 14163, Berlin, Germany*

The Nord-Grundschule (primary school) in Berlin/Steglitz-Zehlendorf celebrated in 2001 its foundation 125 years ago. Within the Energy Saving Partnership Berlin (performance contracting) the Evonik New Energies GmbH realises far-ranging energy saving measures.

The Nord-Grundschule (primary school) was refurbished between 2001 and 2005. The hydraulic of the heating and ventilation system was optimised and a computer controlled energy controlling system which is connected to the Berlin central building control system centre, was installed. Finally the MSR-technology were refurbisehd. This measures were realised within the Energy Saving Partnership Berlin in cooperation with Evonik New Energies GmbH. The energy saving is assured for the contract period of 12 years.





**BILLA**

## Supermarket Klosterneuburg

*Wienerstrasse 9, 3412, Klosterneuburg, Austria*

For this building, energy savings are achieved by implementing a variety of measures such as:

Use of low energy refrigeration: Generous evaporation area, specially built air conduit, use of energy saving circulation ventilation (consumption per ventilator: 7-9 W), use of ventilation in connection with specially constructed electronic control system, electronic control of the glass heater.

Refrigeration, refrigeration systems, condensers and heating systems: Complete heat recovery from the refrigeration is used to heat the supermarket, generous surface area of the condenser, additional heat energy during the cold season can be extracted by the partial use of the refrigeration system as a heat pump. For this purpose special heat pump evaporators and heating control valves were developed.

A two-stage electrical heater is built into the storage tank for extremely cold external temperatures. This can also be used as an emergency heating back up in event of malfunction of the refrigeration plant.

Special electronic controls of the refrigeration plant reacting to the current surrounding temperature and use of special electronic controls for the refrigeration and heating plants.



**New - 2007**

*Type of building:*

**Commercial**

*Area:*

**800 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**71,5 kWh/m<sup>2</sup>yr**

*Investment:*

**252.000 €**

*Annual savings:*

**n/a**

**BILLA**



**New - 2009**

*Type of building:*

**Commercial**

*Area:*

**955 m<sup>2</sup>**

*Reference value:*

**783,07 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**571,88 kWh/m<sup>2</sup>yr**

*Energy savings:*

**27%**

*Investment:*

**160.000 €**

*Annual savings:*

**n/a**

## Penny Supermarket Feistritz

*Rosental - Bundesstraße, 9181, Feistritz, Austria*

The energy concept of the Penny supermarket in Feistritz in Carinthia is similar to the concept that has been applied at the Billa supermarket in Klosterneuburg.

On the one hand this concept deals with energy efficient equipment and HVAC systems like the use of refrigeration units with glass doors or speed-controlled fans. On the other hand the waste heat of the chillers is used for heating of the store in winter.

Additionally a ground source heatpump with two depth drillings provides heat for cold days with temperatures under 0 °C.





## Rotes Rathaus - Tower Hall

*Jüdenstraße 1, 10559, Berlin, Germany*

The energy saving measures in the town-hall are realised within the Energy Saving Partnership Berlin (ESP) with a contract period between 1996 to 2008. During this period the ESP-partner Evonik New Energies GmbH modernised heating, ventilation as well as lighting and installed a central control system.

Within this refurbishment the heating system was equipped with new pumps with pressure-difference-regulation, the operation management was optimised and the hydraulic balance of the system was modernised.

Furthermore the heating transfer station and the distribution system were refurbished. For the ventilation system the power transmission system and the demand regulation were optimised.

In addition the operation time of the lighting was optimised. As a central measure for the ESP a DDC control system was installed.



### Refurbishment

*Type of building:*

**Office**

*Area:*

**33.178 m<sup>2</sup>**

*Before refurbishment:*

**131,51 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**70,62 kWh/m<sup>2</sup>yr**

*Energy savings:*

**46,3%**

*Investment:*

**332.500 €**

*Annual savings:*

**250.000 €/yr**



**New - 2010**

*Type of building:*

**Industrial**

*Area:*

**101.200 m<sup>2</sup>**

*Reference value:*

**80,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**-61,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**176%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Complesso Binario

*Corso Stati Uniti 1/77 - 35127 Padova, Italy*

For this building, energy savings are achieved by implementing a variety of measures such as:

Optimization of the building envelope, tri-generation plant and Multi Solar Power (Photovoltaic and Solar thermodynamic).

Energy production systems can produce (141,5 kWh/m<sup>2</sup>y) 160% of primary energy demand of the building.





## Bohinj Vodni Park

*Triglavska cesta 35, 4264, Bohinjska Bistrica, Slovenia*

The complex is equipped with three air-conditioning systems, each is constructed for a specific type of space and regulatorily optimised. The air-conditioning system has energy saving ventilators with variable speed drive electric motors, filters of fresh and returning air, a big assimetric plate recuperator from polypropylene (effect of heat transfer over 75%), a hot water heater, a heat pump with an evaporator, an air cooled condenser, a water cooled condenser and a freon cooler and an electric control panel with a controller and other necessary control regulation equipment.

Totally 32 m<sup>3</sup>/day of waste hot water, which has to be replaced by fresh water and preliminarily also heated A system, which is a linkage of a recuperator and a heat pump, exploits energy of the waste hot water and heats fresh water.

For hot sanitary water, two tanks are foreseen with 3.000 l each. In one, water is heated to 35°C by means of a heat pump, in the other water is heated to 60°C over a heat exchanger with heating water, regime 80/60°C from the heating plant. A special regulation valve mixes hot sanitary water with 60°C so that consumers receive water with the temperature 45°C. On the other side, fresh cold sanitary water runs over the recuperator and then over the heat pump condenser and is heated to cca 35°C and stored into tanks.



**New - 2004**

*Type of building:*

**Leisure**

*Area:*

**3.000 m<sup>2</sup>**

*Reference value:*

**471,83 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**299,27 kWh/m<sup>2</sup>yr**

*Energy savings:*

**37%**

*Investment:*

**70.000 €**

*Annual savings:*

**29.000 €/yr**





**New - 2010**

*Type of building:*

**Health**

*Area:*

**28.902 m<sup>2</sup>**

*Reference value:*

**52,17 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**28,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**45,2%**

*Investment:*

**282.000 €**

*Annual savings:*

**n/a**

## Hospital Privado Braga

*Lugar da Igreja s/n, 4700, Braga, Portugal*

The building project, dated from 2005, is the typical building design with a large faced window façade, with the typical problems of these buildings: extreme thermal bridges, high amount of daylight exposure, massive needs of hot water, high demand of heating and cooling energy as well as high operational costs.

The Hospital Direction, knowing the importance of European Energy Performance of Buildings Directive (EPBD), developed an action line aiming at promoting the revision of all projects in order to gradually reduce the building greenhouse gas emissions, difining as investment decisions and Goals:

70% hot water needs based in Solar system; double pane windows with insulated frames; light screens and venetian blinds controlled with thermal sensors and solar light input; ventilation system with heat recovery  $\geq 80\%$  and moisture exchange; evaporation humidifier with adiabatic cooling flow control valve; lighting with fluorescent light bulbs with electronic ballasts individually dimmable and daylight control by solar input and increase of thermal insulation for roof and façade.



## Office Building in Bremen

*Am Dobben 44, 28203 Bremen, Germany*

Within the following areas measures to improve the energy performance has been implemented:

Building Envelope: Insulation of walls and window replacement.

Heating: Hydraulic compensation of heating distribution; Insulation of heating system.

Lighting & IT: Installation of efficient lamps and optimisation; Purchase of efficient IT (PCs, LCD monitors).

**BUND**

Landesverband Bremen  
e.V.



### Refurbishment - 2006

*Type of building:*

**Office**

*Area:*

**414 m<sup>2</sup>**

*Before refurbishment:*

**155,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**90,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**42%**

*Investment:*

**70.000 €**

*Annual savings:*

**1.675 €/yr**



## Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**408,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**269,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**34,1%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## The Platinum

*Belgium*

An energy-audit performed by VK Engineering showed several energy saving possibilities in the 'building 'The Platinum' for all the major building components: building envelope: high-efficiency glazing, insulation of wall and roof; HVAC: condensation boiler, heat recovery on ventilated air via a heat recovery wheel and ventilation via variable flow fans; Lighting: placement of high efficiency lighting with daylight and presence control.

The energy-audit measures proposed in the mentioned energy-audit were designed in detail and realised in the period from sep-2009 to mar-2010. The major part of the primary energy saving, i.e. 24%, will be realised via improvement of the HVAC-system.

Energy management is a formal element of the general policy of the organisation. An energy manager is formally assigned and the energy consumption of the building is followed up by means of Excel sheets.







## Wiener Augarten

*Obere Augartenstrasse 1, 1020, Vienna, Austria*

The complex interaction of solar radiation, ventilation and heating makes high demands on the control system. By using dynamic and auto adaptive forecasting models, the heating and ventilation process can be ideally adapted to the expectant solar radiation.

The boiler of the existing biomass plant was replaced by a boiler with 60% more capacity, whereby an increased supply of the nursery via the distributor became possible. With the new plant it became possible to use the whole amount of faulty wood (about 900 m<sup>3</sup>/a) and to reduce the need of district heating. Before the increase of capacity the plant needed about 640 m<sup>3</sup>/a (about 150 t/a). In terms of sustainability the fired biomass will be afforested again in the parks.

The existing hydraulic system became modified according to the effective requirements. A new control system and new valves were installed. Existing heater were refitted with thermostatic valves.

Before, optimisation the control for heating and the control for ventilation were not linked together. Thus interferences of heating and ventilation occurred temporarily. A new DCC-control was installed, which combines both heating and ventilation and makes sure that the required conditions for the plant will be complied. Additionally the aspired improvement of comfort in the undersupplied areas was achieved.



### **Refurbishment - 2005**

*Type of building:*

**Industrial**

*Area:*

**2.500 m<sup>2</sup>**

*Before refurbishment:*

**190,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**105,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**44,7%**

*Investment:*

**99.000 €**

*Annual savings:*

**10.560 €/yr**



**New - 2006**

*Type of building:*

**Educational**

*Area:*

**1.096 m<sup>2</sup>**

*Reference value:*

**146,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**73,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**50%**

*Investment:*

**100.000 €**

*Annual savings:*

**12.000 €/yr**

## Jardim de Infância Popular

*Av. dos Missionários, 2735-951, Agualva-Cacém,  
Portugal*

The building is built in white concrete, thrown in yard, being the south side covered with agglomerated pigmented sawdust of blackcolor cement panels, with volumes which stuck out allowing the solar control as offering a peculiar space for the class activity. The inner face of this structure is covered, almost like a second skin with panels of Thermal insulation, a third skin in bricks protect the insulation panel and guarantees thermal inertia to the inside of the building.

The heating system is based on a mixed system of solar panels and gas boiler, supplying hot water for normal use and to the radiating pavement.

The ventilation of the building is induced by the difference of pressure of the forced extraction of the air which take place in the bathrooms modules. The air enters the building through the systems of grilles included in the thermal fixtures of aluminum.

The system that collect the rain water, converges into a deposit and then redistributes to the flushing system of the W.C.s, being also used to water the garden. The deposit, in the absence of rain, is fed from the public net.





## Piscina Municipal de Restelo

*R. Antão Gonçalves, 1400 – 015 Lisboa, Portugal*

## P. M. do Vale do Fundão

*R. Félix Bermudes, 1950-292, Lisboa, Portugal*

The whole 5 swimming pool complex have 120 thermal solar collectors which will guarantee two thirds of the hot water demand including facilities and services (restaurant, showers and general public toilet). The remaining demand for hot water is provided by natural gas central boiler.

The use of 4 way heat pumps (free-cooling system) for the heating system of the main hall of the swimming pools allows reductions of approximately 35% in the consumption of electric energy and thermal energy.

We'll see in during the description of the other complex, other measures implemented for achieving their energy savings



**New - 2005**

*Type of building:*

**Sports**

*Area:*

**1.838 m<sup>2</sup>**

**2.054 m<sup>2</sup>**

*Reference value:*

**215,62 kWh/m<sup>2</sup>yr**

**244,58 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**88,37 kWh/m<sup>2</sup>yr**

**115,36 kWh/m<sup>2</sup>yr**

*Energy savings:*

**59%**

**53%**

*Investment:*

**2.429.308 €**

**2.498.916 €**

*Annual savings:*

**n/a**



**New - 2005**

*Type of building:*

**Sports**

*Area:*

**1.955 m<sup>2</sup>**

**2.154 m<sup>2</sup>**

*Reference value:*

**254,74 kWh/m<sup>2</sup>yr**

**191,85 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**116,77 kWh/m<sup>2</sup>yr**

**80,68 kWh/m<sup>2</sup>yr**

*Energy savings:*

**54%**

**58%**

*Investment:*

**2.444.934 €**

**2.369.527 €**

*Annual savings:*

**27.579 €/yr**

**n/a**

## P. M. de Santa Maria dos Olivais

*R. Conselheiro Lopo Vaz , 1800-015, Lisboa, Portugal*

## Piscina Municipal de Alvito

*R. Marquês de Pombal, Portugal*

In relation to artificial lighting, the installation of electronic ballasts in the 5 complex, permitted to achieve lighting electricity savings of approximately 30%.

Passive solar measures (double glazing, external shading devices, etc) were also incorporated to the 5 complex, according to the Portuguese national regulations for thermal performance of buildings.

We work to maintain buildings and systems at optimal energy consumption levels and assess performance by evaluating energy use for all major facilities and functions in the organisation.





## Piscina Municipal de Sete Rios

*R. Filipe da Mata 92, 1600 – 073 Lisboa, Portugal*

As the other 4 complex, the swimming pool complex has 120 thermal solar collectors and uses 4 way heat pumps (free-cooling system) for the heating system of the main hall of the swimming pools allows reductions of approximately 35% in the consumption of electric energy and thermal energy.

In relation to artificial lighting, the installation of electronic ballasts permitted to achieve lighting electricity savings of approximately 30%.

Passive solar measures (double glazing, external shading devices, etc) were also incorporated according to the Portuguese national regulations for thermal performance of buildings.

Maintenance of buildings and systems at optimal energy consumption levels. Assess performance by evaluating energy use for all major facilities and functions in the organisation.



**New - 2006**

*Type of building:*

**Sports**

*Area:*

**2.076 m<sup>2</sup>**

*Reference value:*

**198,64 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**83,22 kWh/m<sup>2</sup>yr**

*Energy savings:*

**58%**

*Investment:*

**2.366.000 €**

*Annual savings:*

**n/a**





## Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**2.895 m<sup>2</sup>**

*Before refurbishment:*

**174,09 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**130,57 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25%**

*Investment:*

**n/a**

*Annual savings:*

**13.915 €/yr**

## 3, Iassonos St

*185 37, St. Piraeus, Greece*

For this office building, energy savings are achieved by implementing a variety of measures such as:

**Cooling System:** Installation of high efficient centralized mechanical.

**Artificial lighting:** Using T5 lamps and new luminaries with electronic ballast, and dimmable ones close to natural light area.

**Building Management System:** Installation of BEMS. Monitoring the indoor temperature, humidity etc, and controlling relevant subsystems (heating, cooling, lighting etc.).

**Photovoltaic System:** Installation of photovoltaic system of 9kWp at the roof of the building.

## Kuggen

Sweden

The focus of the energy-saving related to electricity is on operations, which accounts for most of the energy consumption. The technical solutions that have been incorporated are needs-adapted lighting and control of equipment for office workplaces. For the property itself, a system is used that regenerates electricity from lifts in conjunction with braking. There are also needs-adapted lighting and daylight operations in stairwells.

The energy management system includes an energy policy that covers electricity supply for all Chalmersfastigheter's buildings. The policy is confirmed by the CEO and specifies division of responsibility and administrative rules for dealing with energy related issues.



## Vasa Hus 5

Sweden

The building envelope was refurbished to improve energy efficiency. Ventilation is also very poor and needs renovation.

The building will be renovated in a variety of ways. Ventilation will be exchanged and will only be running during office hours, all windows will be exchanged or a third glass will be added to existing glazing. Light sensors will be installed.



New – 2010  
Refurbishment - 2009

*Type of building:*

**Office**

*Area:*

**n/a**

*Reference value:*

**n/a**

**127,27 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**73,00 kWh/m<sup>2</sup>yr.**

**84,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**>25%**

**34%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment - 2009

*Type of building:*

**Educational**

*Area:*

**n/a**

*Before refurbishment:*

**100,00 kWh/m<sup>2</sup>yr**

**100,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**75,00 kWh/m<sup>2</sup>yr**

**67,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25%**

**33%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Najaden N5

*Sweden*

## Tessin N

*Sweden*

The reasons for the low energy use are as follows: the building has a good 'climate shell', with low U-values for all parts of the construction (U-value roof = 0.20 W/m<sup>2</sup>, K; U-value foundation = 0.20 W/m<sup>2</sup>, K; U-value facade = 0.25 W/m<sup>2</sup>, K; U-value window = 1.8 W/m<sup>2</sup>, K); ventilation air is heat exchanged; the air treatment units are only in operation when the building is in use, i.e. weekdays, daytime; electricity-efficient fans have been installed; the building and its installations are well maintained.

The Chalmersfastigheter in-house environment and quality management systems include integrated routines for the energy savings program.

## Vasa Hus 7

*Sweden*

For this building, energy savings are achieved by implementing a variety of measures such as:

New system for ventilating the building has been installed. The ventilation air is heat exchanged; the air treatment units are only in operation when the building is in use, i.e. weekdays, daytime; electricity-efficient fans have been installed.

The building and its installations are well maintained.



### Refurbishment - 2009

*Type of building:*

**Educational**

*Area:*

**n/a**

*Before refurbishment:*

**135,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**64,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**53%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2009**

*Type of building:*

**Educational**

*Area:*

**817 m<sup>2</sup>**

*Reference value:*

**131,16 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**58,76 kWh/m<sup>2</sup>yr**

*Energy savings:*

**55,2%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Kinderhaus Eltersdorf

*Anna-Goes-Straße 13, 91058, Erlangen, Germany*

Two kindergarten groups, an after-school care club and a nursery will be accommodated in the new building. The compact building has two floors. The ground floor will accommodate one kindergarten group and the nursery. The second kindergarten group and the after-school care group will use the first floor area. The goal is to construct a model building in terms of energy efficiency. The concept therefore is a low energy building with a highly insulated facade. The building is heated with a brine-water heat pump. The central heating system with heat recovery reduces the energy demand as well.

Heating: water-brine thermal heat pump with heat buffer,

Building Envelope: timber frame construction, thermal insulation system, green roof with insulation, triple pane windows.

Ventilation: central ventilation system with heat recovery.

Calculation according to the German energy savings ordinance (EnEV), with reference to the building's primary energy demand.





## MRB Kature Labin

*Stambeno-poslovna zgrada Kature, Labin, Croatia*

Three buildings of low energy standard are built for young families in City of Labin. Based on energy, economy and ecology feasibility optimal energy efficiency measures are selected.

High level of heat retention is achieved with 14 to 30 cm of thermal insulation in all construction elements.

Air-water heat pumps will be used for centralized heating, cooling and SHW production as well as mechanical ventilation in kitchen and bathroom area. Floor and wall panel heating and cooling will be used.

Building will be graded in energy class A according to energy Certification scheme in Croatia.

(In Croatia there are no legal values for primary energy and all calculations and comparisons are made based on heat energy demand)



**New - 2009**

*Type of building:*

**Social**

*Area:*

**3 x 1.625 m<sup>2</sup>**

*Reference value:*

**70,33 kWh/m<sup>2</sup>yr**

*Heat energy demand:*

**24,82 kWh/m<sup>2</sup>yr**

*Energy savings:*

**64,7%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2009

*Type of building:*

**Educational**

*Area:*

**6.830 m<sup>2</sup>**

*Before refurbishment:*

**162,63 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**91,40 kWh/m<sup>2</sup>yr**

*Energy savings:*

**43,8%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Goethe Gymnasium

*Goethestr. 1 93049 Regensburg, Germany*

For this building, energy savings are achieved by implementing a variety of measures such as:

Building envelope: Façade: 14 cm thermal insulation composite system, Cellar: vacuum insulation, Roof: expanded polystyrene, Windows: new double-glazing insulation windows.

Heating: combined heat and power unit (gas) 640/15 kW.

Ventilation: ventilation system with heat recovery  $\geq 75\%$ .

Lighting: energy saving fluorescent tubes.

Calculation according to the German energy savings ordinance (EnEV), with reference to the building's primary energy demand.





## Gymnasium Sonthofen

*Albert-Schwitzer-Str. 1, 87527 Sonthofen, Germany*

For this building, energy savings are achieved by implementing a variety of measures such as:

Heating: geothermal heat pump and gas condensation boiler; panel heating; system temperature 35/25.

Ventilation: ventilation system with heat recovery  $\geq 80\%$ .

Lighting: Fluorescent light bulbs with electronic ballasts.

Building envelope: 20 cm mineral insulating board with  $U = 0,21$  W/m<sup>2</sup>K; Windows: triple-pane-windows with  $U = 1,00$  W/m<sup>2</sup>K; Roof: 24 cm mineral insulating board with  $U = 0,18$  W/m<sup>2</sup>K.



### Refurbishment - 2010

*Type of building:*

**Educational**

*Area:*

**8.157 m<sup>2</sup>**

*Before refurbishment:*

**345,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**138,20 kWh/m<sup>2</sup>yr**

*Energy savings:*

**60%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment - 2009

*Type of building:*

**Educational**

*Area:*

**7.530 m<sup>2</sup>**

*Before refurbishment:*

**96,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**58,80 kWh/m<sup>2</sup>yr**

*Energy savings:*

**38,7%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Comenius Realschule

*Reichenberger Straße 6 - 97877 Wertheim, Germany*

The school building, that was constructed in the 1970th, will be extensively refurbished. A cafeteria is being added. In this process all is being adapted to today's standards:

Heating – exchange of boiler already done in 2003: Wooden pellet boiler with 500 kW.

Ventilation system with heat recovery  $\geq 75\%$ , Earth tubes used as heat exchanger in winter and for cooling in summer are connected to ventilation system for support and energy saving.

Lighting: Increase of the transparent façade area for daylight use, Rod-shaped fluorescent tubes with ballasts and daylight control mechanism; present detectors.

Building envelope: Façade: 14 cm mineral wool,  $U = 0,25$  W/m<sup>2</sup>K, Basement ceiling: 12 cm polystyrene,  $U = 0,20$  W/m<sup>2</sup>K.

Calculation according to the German energy savings ordinance (EnEV), with reference to the building's primary energy demand.







## CKG Bethlehem

*Belgium*

The building will be constructed according to the 'Passive house' concept, thus: very good insulation of the building envelope; very airtight building envelope; heat recovery with a high efficient heat recovery unit (efficiency = 90%).

On top of this, the HVAC-system will consist out of a Borehole Thermal Energy Storage and Concrete core activation.

Furthermore a SWW solar system and a PV-installation will be realised as well.

The new building will be followed up via a professional energy monitoring system.



**New - 2010**

*Type of building:*

**Health**

*Area:*

**1.150 m<sup>2</sup>**

*Reference value:*

**163,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**100,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**39%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Sports**

*Area:*

**18.976 m<sup>2</sup>**

*Reference value:*

**696,46 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**320,75 kWh/m<sup>2</sup>yr**

*Energy savings:*

**46%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Can Llong

*C/ Budapest, 1, 08206 Sabadell, Spain*

For this building, energy savings are achieved by implementing a variety of measures such as:

Lightning: Electronic ballast; Low-energy and high-efficiency LED lightning with volumetric sensors.

HVAC system: Cogeneration system; Heat recovery ventilation.

Hot Sanitary Water: Water recirculation.

Passive solutions: Ventilated roof: radiation control and easy maintenance, Steel profile system in façade.



## Silvertower

*Jürgen-Ponto-Platz 1, 60301, Frankfurt, Germany*

The building consists of two shifted square-cut towers and two tributary towers containing staircases and elevators. The rentable floor areas are designed as open plan offices. Furthermore, some storeys contain assembly rooms or conference rooms. The two storeys in the basement and two other storeys in the upper areas exclusively contain technical equipment.

Due to its age of more than 30 years, the total building needs to be refurbished. Actions within this particular intervention are the renovation of the facade (particulary reused), remodelling the office layout in the general floor areas, and the renewal of the technical equipment. Furthermore, structural modifications due to increased fire protection requirements need to be implemented.

Building envelope: Localization and elimination of thermal bridges; Changing type of glazing: Heat mirror double glazed unit

District heating with heat recovery. Installation of well dimensioned heating pumps with power regulation.



### Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**76.599 m<sup>2</sup>**

*Before refurbishment:*

**362,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**221,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**38,8%**

*Investment:*

**21.505.180 €**

*Annual savings:*

**n/a**



## Refurbishment - 2005

*Type of building:*

**Office**

*Area:*

**2.038 m<sup>2</sup>**

*Before refurbishment:*

**46,94 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**26,80 kWh/m<sup>2</sup>yr**

*Energy savings:*

**75%**

*Investment:*

**35.000 €**

*Annual savings:*

**37.380 €/yr**

## Edifício A Complexo Miraflores

*Alameda António Sérgio, N<sup>o</sup> 62, 2795-221 Linda-a-Velha, Lisboa, Portugal*

The general concept aimed to reduce energy losses through glazing elements, roof, floor and walls (exterior and interior), as well to optimise solar gains.

The retrofit of Building A was based on the envelope structure and lighting system, complemented by interventions on heating and ventilation. Main measures:

Building envelope: reduction of 1/3 of windows previous height in which were installed double glazing of low thermal transmittance values, with air cavity; internal blinds to control lighting level and uniformity; double wave form roof (DIN 1725 specifications), with a vapour barrier; garden terrace in the west area of the roof and use of vegetation to shade surfaces in summer and reduce air temperature around the building (in South and West facades) via evaporation and transpiration.

Lighting: electronic ballasts and energy efficient lamps (T5); vertical reflector system in single office rooms.

Energy management: maintenance of buildings and systems at optimal energy consumption levels; assess performance by evaluating energy use for all major facilities and functions in the organisation; integration of energy efficiency criteria at future purchasing decisions and for future building refurbishment; shading devices in South and East facades.





## Polo territoriale prima infanzia con asilo nido

*Via C. Battisti, 115, 20093 Cologno Monzese, Italy*

The building is equipped with two ground water heat pumps which, during summer, could be used in free-cooling mode. Space heating is provided by radiant floor panels. Renewable energy is delivered with a photovoltaic plant system (110 m<sup>2</sup>).

Energy saving measures include: improving insulation of building envelope (opaque and transparent components); reducing unwanted solar heat gains by the presence of permanent shading devices and of trees; selection of energy efficient technical equipment; optimization of the regulation; selection of variable speed motors and fans; natural ventilation strategies; optimization of the daylight through skylights.



**New - 2010**

*Type of building:*

**Educational**

*Area:*

**673 m<sup>2</sup>**

*Reference value:*

**85,58 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**9,74 kWh/m<sup>2</sup>yr**

*Energy savings:*

**88,7%**

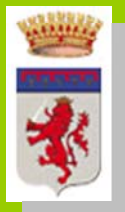
*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment - 2007

*Type of building:*

**Educational**

*Area:*

**3.900 m<sup>2</sup>**

*Before refurbishment:*

**94,87 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**53,72 kWh/m<sup>2</sup>yr**

*Energy savings:*

**42,8%**

*Investment:*

**90.000 €**

*Annual savings:*

**11.200 €/yr**

## Scuola Tolosano

*via Tolosano, 76, 48018, Faenza, Italy*

In order to reduce the heating primary energy consumption of the school, two groups of actions have been planned.

In the first phase the flexibility of the system was improved by means of installation of a new control system which allows to optimize the operating period of the heating generator with the presence of the users. An annual energy savings of 18% has already been achieved.

The second group of measures includes the improvement of the roof insulation adding 80 mm of fiberglass from the interior side. Moreover, for a further enhancement of the heating system efficiency the old boiler will be replaced with a new condensing boiler and thermostatic valves will be installed in all the radiator.







## Dirección General de la Mujer

*C/ Alcalá n° 253, 28027 Madrid, Spain*

The improvement of the measures is planned to be achieved in the next steps:

Contracted power reduction from the initial 451 kW to 250 kW.

Indoor Lighting: Incorporation of light sensors for the main common areas of the buildings (corridors, halls, etc.) and improvement of the building light control system, including the program of the system.

Air Conditioning: Adjustment of the parameters in the heat pumps and air conditioning machines according to normative and energy saving parameters. Control system updating; Fan-coils regulation and control improvement; Temperature sensors and control system incorporation in each floor.



### Refurbishment

*Type of building:*

**Institutional**

*Area:*

**4.600 m<sup>2</sup>**

*Before refurbishment:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

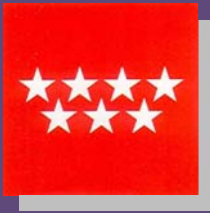
**28,7 kWh/m<sup>2</sup>yr**

*Investment:*

**101.582 €**

*Annual savings:*

**n/a**



## Refurbishment

*Type of building:*

**Institutional**

*Area:*

**n/a**

*Before refurbishment:*

**2.316.349,10 kWh/yr**

*Primary energy demand:*

**1.702.584,72 kWh/yr**

*Energy savings:*

**26,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Consejería de Empleo y Mujer

*C/ St. Hortensia, 30, Madrid, Spain*

For this building, energy savings are achieved by implementing a variety of measures such as:

Study of the ontracted electricity power and adequation to real demand.

Installation of sensors in areas with high natural lighting. In such units, natural light falls directly through the windows. These devices regulate artificial light depending on the amount of natural light at any given time, increasing the life of the lamps and creating a more pleasant environment for workers. Installation of programmed schedules in the lighting of each floor that serve the working rooms of the building, including lighting lines in corridors and common areas. Replacing halogen lighting for CFLs.

Adjusting the air conditioning system.

Heating improvement.

Replacing the existing faucet incorporating timed faucet aerators. The faucet timer allows an estimated saving of 65%.

It is proposed to perform an PV-installation of 30 kWp on the roof of the building.





## CyO New Headquarter

*53, Botanica street in l'Hospitalet de Llobregat, Spain*

The design takes into account the orientation and natural ventilation of the building. It benefits of the sun's penetration in the interior of the building to achieve a saving of artificial illumination and it uses the heat gain from solar radiation in winter. It seeks to integrate natural vegetation ensuring the continuity between the different green masses. A continuous ecosystem facilitates the cooling of the facades as it controls and regulates the humidity and temperature of the façade perimeter. HVAC systems for the different spaces: It is intended to adjust the temperature and humidity of the air-conditioned environment; Orientation of facades and grouping spaces or rooms with equivalent thermal conditions; Discrimination by use and operation schedules; 4-pipes induction units, mounted in the false ceiling, will be used to condition the main areas of the building; Water radiators shall be used to heat the perimeter office areas in order to support the action of the induction units. 2 Horizontal VAV Air Handling Units will be used to provide the required outdoor air of ventilation. In these systems an enthalpic heat recovery unit will be added in order to remove 100% of the used air of the conditioned spaces and supply 100% of outdoor fresh air. It has been foreseen the use of fluorescence lighting with compact lamps or low energy consumption tubes, with strategies of lighting control. In the building cover it has been foreseen the installation of a photovoltaic pergola of 39,84 kWp.



**New - 2008**

*Type of building:*

**Office**

*Area:*

**5.105 m<sup>2</sup>**

*Reference value:*

**373,62 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**180,08 kWh/m<sup>2</sup>yr**

*Energy savings:*

**51,8%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2008**

*Type of building:*

**Industrial**

*Area:*

**33.795 m<sup>2</sup>**

*Reference value:*

**38,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**19,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**50%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Logispark Meco

*P.I. MECO, Madrid, Spain*

To reduce electricity consumption for lighting in the building, measures will be implemented for better use of natural light. Using a higher light transmittance material for the skylights in we achieved a most important entry of natural light in the aisles. The material used is a polycarbonate with a transmittance of at least 30%.

Regulation of artificial lighting by photosensors to adjust the light intensity of lamps according to the amount of natural light available inside the ship at all times.

There is potential for energy savings through increased efficiency of lighting for walkways, locker rooms and bathrooms in office buildings. Therefore we used compact fluorescent lamps, low consumption in these areas. Besides motion detectors were installed in the changing rooms and bathrooms. This measure has been evaluated considering that reduces the number of operating hours of lighting.

A solar photovoltaic plant is installed on the deck of the building. The facility will be connected to the network and its expected annual production is estimated at 346 MWh/ year.





## New Publishing Building

*Mecklenburgische Straße 46, 14197, Berlin, Germany*

Room temperature is regulated not by climate control, but rather by extensive low-energy thermal use of concrete cores in ceilings and floors.

Special light-reflecting slats on the window blinds adapt to the incoming sun and further contribute to savings on heating costs, for example by being closed at night to prevent loss of heat. In the daytime, they optimise natural lighting in the office together with the light provided by the 350 overhead lights, helping to reduce energy costs.

By means of a photovoltaic assembly on the roof, electric energy can be fed into the public system. Last year, Cornelsen was able to create 19,188 kWh of green power in this way and make it available to the Berlin electrical system.

Window glass panels help to reduce outside noise, even when the windows are open. With the help of natural ventilation, artificial ventilation of the offices can be avoided.

In addition, water from precipitation is collected and used for flushing the toilets and watering the greenery.



**New - 2004**

*Type of building:*

**Office**

*Area:*

**7.500 m<sup>2</sup>**

*Reference value:*

**101,47 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**69,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**32%**

*Investment:*

**n/a**

*Annual savings:*

**130.000 €/yr**

**CORPUS SIREO**



**Refurbishment - 2007**

*Type of building:*

**Office**

*Area:*

**36.493 m<sup>2</sup>  
4.855 m<sup>2</sup>**

*Before refurbishment:*

**102,47 kWh/m<sup>2</sup>yr  
227,72 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**53,80 kWh/m<sup>2</sup>yr  
94,05 kWh/m<sup>2</sup>yr**

*Energy savings:*

**47,5%**

**58,7%**

*Investment:*

**n/a  
301.200 €**

*Annual savings:*

**n/a  
84.300 €/yr**

## Büro-und Technikkomplex

*Bauerbergweg 23-25, 22111 Hamburg, Germany*

## DTAG Büro-und Technikgebäude

*Budapester Straße 18, 20359 Hamburg, Germany*

To significantly reduce the offices building's energy demand, the whole heating system was optimized.

Heating: District heating from a cogeneration power plant; all mixers, pumps and switches were removed; the system is now supplied by an Inline-Pump; all heaters received pre-adjustable valves; the capacity of the boiler unit was reduced from 2,8MW to 1,28MW.

Electric appliances improvement.





## Company headquarters

*Kifisias 44 Ave. – Athens, Greece*

## Operations center

*Aharnon Str 434 – Athens, Greece*

For this buildings, energy savings are achieved by implementing a variety of measures such as:

Lighting: Replacement of ballasts; Lighting Controls: Timing in basements; Timers on lighting of special areas & external spaces and connection with BMS

Heat recovery: Installation of heat exchangers to recover heat from exhausted air.

Power factor: Improvement of power factor correction.

HVAC control: Improved control for HVAC (mainly VRF) systems.



### Refurbishment

*Type of building:*

**Office**

*Area:*

**9.720 m<sup>2</sup>**

**7.400 m<sup>2</sup>**

*Before refurbishment:*

**239,40 kWh/m<sup>2</sup>yr**

**494,05 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**42,80 kWh/m<sup>2</sup>yr**

**333,25 kWh/m<sup>2</sup>yr**

*Energy savings:*

**82%**

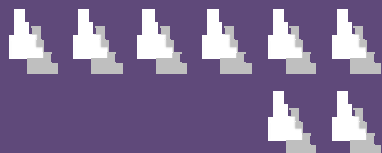
**32,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment

*Type of building:*

**Municipality**

*Area:*

**10.590 m<sup>2</sup>**

*Before refurbishment:*

**170,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**37,34 kWh/m<sup>2</sup>yr**

*Energy savings:*

**78%**

*Investment:*

**347.200 €**

*Annual savings:*

**77.300 €/yr**



## Ayuntamiento; Servicios Sociales; Centro Cívico; Centro de Salud; Frontón; Polideportivo; Piscinas municipales y Colegio comarcal

*Spain*



Ultzama is located in a valley of the north of Spain, considered a zone with great environmental. The council of Ultzama, always concerned about the sustainability, in 2008 undertake an economical investment with the objective of better using the natural resources of the municipality. Main measures implemented in all these 8 buildings are:

**Building envelope:** The actions mainly consist in add insulation in roofs, floors, and in external and internal walls in these points where it didn't exist. Also in improving the already existing insulation and in changing the window glasses and frames in order to reduce their U-value from 5 to 1.6 or 1.8 W/m<sup>2</sup>K.



Substitution of old natural gas and propane boilers for biomass boilers: The biomass comes from the Ultzama valley itself. The municipality of Ultzama has an extension of 96 km<sup>2</sup>, from which 64 km<sup>2</sup> are forests. Exactly, the Forestry Management Plan of Ultzama plans the generation of biomass, which is sufficient for feeding all of the existing biomass boilers and also for other uses.

The old boilers were situated in each building. Now, as the buildings are close one to the other, the biomass boilers will be installed in a centralized boiler room. Therefore, heat will be delivered to each building through district heating.

Hiring of "Green Energy Line", which guarantee you that the electricity supplied comes from 100% renewable resources. The council awarded to the company Bioenergía Ultazama the construction and exploitation of a biogas plant working with the cow manure from the valley (80000 tons/year). This will generate 500 kWh of green electricity, which will be delivered to the grid according the Royal Decree 661/2007. So, as you can see, the origin of the energy is from Ultzama Valley and totally renewable.

Lighting system: replacement of the old lamps for high efficiency ones, lighting control through photosensors and presence detectors.



## Refurbishment

*Type of building:*

**Municipality**

*Area:*

**10.590 m<sup>2</sup>**

*Before refurbishment:*

**170,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**37,34 kWh/m<sup>2</sup>yr**

*Energy savings:*

**78%**

*Investment:*

**347.200 €**

*Annual savings:*

**77.300 €/yr**





**New - 2010**

*Type of building:*

**Office**

*Area:*

**2.500 m<sup>2</sup>**

*Reference value:*

**223,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**165,50 kWh/m<sup>2</sup>yr**

*Energy savings:*

**26%**

*Investment:*

**61.000 €**

*Annual savings:*

**n/a**

## Friedrichstraße 19

*25980, Westerland / Sylt, Germany*

Modern office and retail building in the centre (pedestrian area) of Westerland/Sylt. Flexible footprints for two storey retail spaces and flexible office-size.

High effective insulation in walls and glass-facade with external sunscreens and latest technology with district heating, heat recovery, optimization of temperature regulation and installation of highly efficient fluorescent lamps, help saving of energy.



## WestendGate

*Hamburger Alle 2-4, 60325, Frankfurt am Main,  
Germany*

For this office building, energy savings are achieved by implementing a variety of measures such as:

Heating: four new boilers: two Water/Water boilers for the office part with 2.300 kW and two low pressure boilers for the hotel. Combined heat and power plant mainly for WW with 5.000 l buffer storage. Hotel heated via air conditioning plant and fan coils. Offices heated via induction appliance.

Lighting: Offices: unified lighting with mirror reflectors daylight control. Hotel: energy efficient fluorescent tubes (0,08W/tube). Illuminated advertising now with LED (0,1 W/m<sup>2</sup>).

Building envelope: new aluminium ventilated curtain wall; insulation of cavities with mineral wool 10 cm. Thermal interior insulation of office areas with FOAMGLAS U = 0,045 W/m<sup>2</sup>K. Cooling ceiling venetian blinds controlled with light sensors.

Renewables: photovoltaic system in the South-East.



### Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**80.784m<sup>2</sup>**

*Before refurbishment:*

**334,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**214,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**36%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





**New - 2010**

*Type of building:*

**Office**

*Area:*

**66.061 m<sup>2</sup>**

*Reference value:*

**186,66 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**136,73 kWh/m<sup>2</sup>yr**

*Energy savings:*

**26,8%**

*Investment:*

**61.000 €**

*Annual savings:*

**n/a**

## GAP 15

*Graf-Adolf-Platz 15, 40213, Düsseldorf, Germany*

The building complex comprises two office buildings founded on a shared basement. The high rise office building has 24 storeys, the other office building has 5 storeys above ground. The façade of this building is a punctuated facade with historical proportions. The high rise building has an all-glass façade. All windows include automatic mobile external shading. Both building parts are equipped with identical technical installations.

Heating is produced by district heating. Rooms are heated through the ventilation system and through heaters. Cooling is provided by three compressors connected to cooling towers. Cooling is distributed into the rooms through the ventilation system by cooling ceilings and can be adjusted individually.

Lamps are mainly fluorescent lamps equipped with electronic ballast.

A building management system (BMS) is installed. Energy consumption is metered by the BMS. All technical installations can be controlled by the BMS. No interventions are planned for the recently erected building.





## Spherion

*Schwannstr. 6, 40476, Düsseldorf, Germany*

The office building was constructed in 2003. In 2004 it received two awards for its architecture, efficiency and office composition: "Office of the Year 2004" and "Best Office 2004".

Energy concept: Day light control; Temperature regulation of the building core; Intelligent building control.



**New - 2003**

*Type of building:*

**Office**

*Area:*

**22.838 m<sup>2</sup>**

*Reference value:*

**149,61 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**95,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**36,5%**

*Investment:*

**n/a**

*Annual savings:*

**166.953 €/yr**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**9.249 m<sup>2</sup>**

*Reference value:*

**256,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**182,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**28,9%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## DNV Building

*Łużycka Office Park, ul. Łużycka 6, 81-537 Gdynia,  
Poland*

Set of energy efficiency (EE) measures has been implemented in the DNV Building. The scope of measures was limited by the building permit and necessary uniformity of all five office buildings within the Łużycka Office Park in Gdynia, Poland.

The measures DNV has taken include mainly: Thickness of walls and roofs has been increased till possible limits; Windows of better U-value have been used; Quality and quantity control of domestic hot water (DHW) has been introduced, including non-touch fittings and individual thermostatic mixers; Introduction of free-cooling to one chiller supplying fan-coils; Partial lighting control has been introduced including presence sensors in sanitary rooms and part of common areas, control of lighting intensity and connection to BMS.

DNV Building Action Plan covers also: energy management objective setting (as a part of certified ISO 14001 system); energy efficiency training for all DNV Personnel; monthly monitoring and management of all significant energy efficiency data (especially HVAC energy efficiency, temperature, humidity, heat recovery effectiveness monitoring), monitoring of other sources of energy usage & effectiveness and lighting energy efficiency (light intensity).





## Lufthansa Aviation Center

*Airportring 60546 Frankfurt am Main, Germany*

For this office building, energy savings are achieved by implementing a variety of measures such as:

Heating: Thermal active building components, Individual controlled heating and cooling in all offices, Heat recovery plant.

Summer heat control with exterior sun screens that are controlled by incidence of light (with closed screens daylight use is possible). Offices facing: if closed, less than 10% of the sun's energy enters the rooms. Slat blinds are individually controllable; central control does not allow direct sunlight to enter offices.

Building insulation improvement.



**New - 2006**

*Type of building:*

**Office**

*Area:*

**50.600 m<sup>2</sup>**

*Reference value:*

**173,17 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**71,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**59%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2009

*Type of building:*

**Commercial**

*Area:*

**7.100 m<sup>2</sup>**

*Before refurbishment:*

**234,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**145,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**38%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Dykaren 17

*Gyllen, Sweden*

Before refurbishment: The buildings system for ventilation, from 1968, is mainly CAV (Constant Air Volume) without any possibility to recycle energy. To regulate heating and cooling the building use an old, not computerised, system.

The refurbishment project comprised four new units with recycling of heat during the winter and cooling during the summer. The ventilation system is now a VAV (Variable Air Volume) with possibility to utilize several options to minimize the fan electricity. A new web-based system for regulation is installed and makes it easier to work with energy efficiencies, continuously. The units have its separate built-in cooling machine and heating is delivered from a district heating system.

Energy consumption is ensured through energy simulations during the design phase.





## RMI – Türkiye

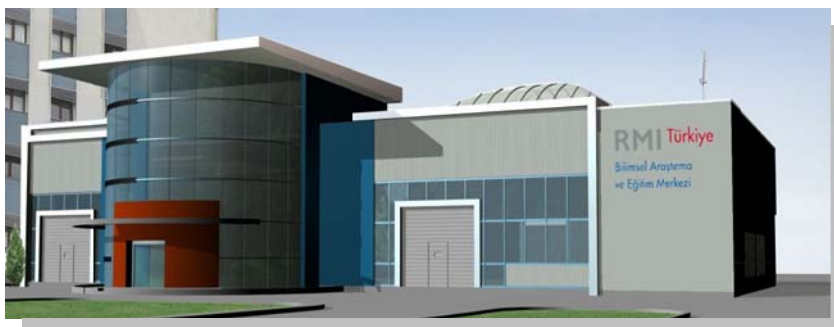
*Gebze, Kocaeli, Turkey*

In order to minimize the heating and cooling demand of the building, 8 cm thick carbon filled expanded polystyrene insulation boards, which is about twice the requirements of the corresponding national standard is installed.

A ground source heat pump system (GSHP) is installed in order to provide the energy for heating and cooling of the building. A vertical closed loop system with 22 double-U bore-holes, each 100 m deep, use the earth's constant temperature as a heat sink in the summer and a heat source in the winter. Twenty-seven heat pump units are used to distribute heated or cooled air throughout the building. The efficiency of the heat pump system will be monitored using sensors and a data acquisition system.

Skylights meet approximately 90 % of the lightening need of the located halls. Designers also took into account the path of the sun so as to maximize the solar gain and day light potential in winter months and minimize the glare and solar gain in summer months. In some of the office space, solar tubes were used to provide additional day light. Another approach to maximize day light potential while keeping solar gain as low as possible was the utilization of double pane glass with low emission coating.

Fresh air for the building is introduced through an air-to-air heat exchanger. Water-to-water GSHP's also provides the extra energy to fix the temperature of the inlet air through an automation system.



**New - 2007**

*Type of building:*

**Office**

*Area:*

**1.763 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**54%**

*Investment:*

**192.437 €**

*Annual savings:*

**11.170 €/yr**





**New - 2008**

*Type of building:*

**Office**

*Area:*

**4.700 m<sup>2</sup>**

*Reference value:*

**48,53 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**26,79 kWh/m<sup>2</sup>yr**

*Energy savings:*

**44,8%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Berliner Allee, 43

*40212, Düsseldorf, Germany*

The new headquarter offices of the Düsseldorfer Hypotheckenbank is a highly innovative and energy efficient building.

The building is cooled with a thermo active building system and a modern air handling unit. The energy for heating and warm water is mostly provided by a geothermal heat pump with 12 geothermal probes in a depth of 100 m.

All heating and cooling appliances are controlled via bus-system.

Lighting is day light controlled. Daylight is used even with closed window blinds, through controlled light incidence of roof light, Individual light control in each room; motion detectors.







## Kantoren en Magazijn

*Belgium*

The building that still is in the design phase will be constructed according to the 'Passive house' concept or at least according to the 'low-energy concept', thus: very good insulation of the building envelope e.g. wall insulation 21-25 cm etc.; very airtight building envelope; heat recovery with a high efficient heat recovery unit; heat pump and condensation boiler and a 40 kW PV-installation.

An energy manager is formally assigned and all the buildings of the organisation are followed up by means of a professional telemetric energy monitoring system.



**New**

*Type of building:*

**Office**

*Area:*

**560 m<sup>2</sup>**

*Reference value:*

**220,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**110,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**50%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2007**

*Type of building:*

**Commercial**

*Area:*

**13.809 m<sup>2</sup>**

*Reference value:*

**271,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**150,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**44%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Hyvinkää Home Center

*Sveitsinportti area, Hyvinkää, Finland*

To achieve energy savings following solutions were realised:

Designing an energy efficient building concept, including technical solutions in isolation, air tightness and air conditioning together with heat recovery and CO<sub>2</sub>- detectors.

Minimum sized air ducts often leads to rooms with fixed purposes. Therefore all ducts are being over dimensioned as well as the units to achieve flexibility. By over sizing the ducts and the units the air pressure will be far lower, resulting in lower energy consumption of the fans.

HRVs recover the heat energy in the exhaust air, and transfers it to fresh air as it enters the building. HRV provide fresh air and improved climate control, while also saving energy by reducing the heating (or cooling) requirements.

Air tightness has to be perceived in designing, executing and monitoring a building. Excessive air leakage results in increased energy consumption and a drafter cold building. Air leakage is driven by differential pressures, across the building envelope.

An operation manual was made and given with instructions to the parties involved on how to use the building in the best way. This also ensured proper management of initialization.

Follow-up on operations, including energy consumptions, to ensure proper use of the building.





## EE info corner

*Croatia*

The existing office building of 37 m<sup>2</sup> is intended for Energy Efficiency info corner for the city of Prelog, Croatia.

In the reconstruction of the building, external wall of brick elements is thermally insulated with 12 to 16 cm of thermal insulation in ETICS system ( $U=0.22$  W/m<sup>2</sup>K), ceiling towards attic with 25 cm ( $U=0.14$  W/m<sup>2</sup>K), ceiling towards unheated cellar with 10 cm ( $U=0.43$  W/m<sup>2</sup>K).

New PVC frame windows with double insulating glass low-e coating are built in. Internal shades are used.

Existing façade plaster coating is removed and capillary moisture is excavated from walls.

Heating system consists on combined boiler using natural gas and radiator distribution system.

(In Croatia there are no legal values for primary energy and all calculations and comparisons are made based on heat energy demand.)



### Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**36 m<sup>2</sup>**

*Before refurbishment:*

**94,18 kWh/m<sup>2</sup>yr**

*Heat energy demand:*

**62,16 kWh/m<sup>2</sup>yr**

*Energy savings:*

**34%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2006

*Type of building:*

**Office**

*Area:*

**2.000 m<sup>2</sup>**

*Before refurbishment:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**50%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Renewable Energy House

*Rue d'Arlon 63-65, 1040, Brussels, Belgium*

In the Renewable Energy House, geothermal energy is used in the form of a geothermal heat pump with 4 vertical borehole heat exchangers ("vertical loops") each 115 m deep. During winter the heat pump is used to heat the back building offices and conference rooms. The geothermal system is not only used for heating but acts also as a heat sink for the excess condensor heat of the solar absorption cooling system in summertime. The Renewable Energy House is equipped with an 80 kW pellet heating system and has two interconnected storage rooms which can take approximately 15 tons of pellets. The boiler heating system is implemented as an underfeed firing system with afterburn ring. Ignition is carried out fully automatically. In the primary combustion area (burner plate), the fuel is fed in from underneath in a controlled way and, together with the slow primary-air flow, provides a smooth fuel bed, low dust emissions and optimum gasification conditions. The output of the boiler can be adjusted to the heating requirements, in a fully automatic way, from stand-by to full-load operation. The pellet boiler is connected to the 5000 l hot water storage tank and heats the main building of the Renewable Energy House. The pellet boiler is equipped with a fully automatic ash compaction unit. The ash is fully compressed so that it is only necessary to empty the ash box, depending on the boiler output, every 2 to 3 months. Ash contains pure minerals and is the perfect fertilizer for garden, lawn and forest.



## Church Stadl Paura

*Kirchengasse 1, 4651, Stadl-Paura, Austria*

The central heating system is supported by a solar heating system of 60 m<sup>2</sup> situated on the roof of the church (angle: 60°). The solar heat gets into two hot water storage tanks of 5.700 l. When there is not enough solar energy a gas condensing boiler, heats up. The old radiance radiators has been exchanged through new convective radiators. There are four heater loops which are controlled depending on the outside temperature.

The former existing roof was neither isolated nor vacuum sealed. On cold days the church got icy only a few minutes after turning down the electric heating. On summer days there was overheating because of the lack of isolation. As result of the refurbishment the roof got inside a 25 cm cellulose isolation between its rafter. Thereby, the comfort inside the church has been raised.

The church's illumination consisted of 30 neon-lamps, each 36 Watt, for indirect lighting. They have been exchanged through four big halide lamps of 150 W. Each of them is switchable on its own.

The water heating was electrical (2x 3.000 Watt). Now the supply (fresh/hot water preparation) happens over the central heating system (solar system).



### Refurbishment - 2005

*Type of building:*

**Religious**

*Area:*

**n/a**

*Before refurbishment:*

**8.600 kWh/yr**

*Primary energy demand:*

**4.300 kWh/yr**

*Energy savings:*

**50%**

*Investment:*

**71.000 €**

*Annual savings:*

**2.500 €/yr**





## Refurbishment - 2007

*Type of building:*

**Office**

*Area:*

**307 m<sup>2</sup>**

*Before refurbishment:*

**108,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**15,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**86%**

*Investment:*

**361.152 €**

*Annual savings:*

**5.574 €/yr**

## Nullenergiebüro Manschein

*In Lüssen 14, 2191, Gaweinstal, Austria*

To achieve energy savings following solutions were realised:

Installation of 32m<sup>2</sup> of thermal solar collectors with 2000 l of hot water storage (50% of the heat demand); 750 m<sup>2</sup> soil collector for the heat pump (50%), Floor heating and very low temperature dimensioning radiator and air heaters (for the storage) result to a high COP of the heat pump.

Solar cooling: 32m<sup>2</sup> of thermal solar collectors with adsorption, refrigeration, cooling and dehumidification of the delivery air (50% of the cooling demand). Cooling with 750 m<sup>2</sup> soil collector (40%), Free-Cooling with a high ventilation rate during nights with low temperatures (10%).

42 m<sup>2</sup>-PV-unit (5 kWp) produce 100% of the electricity for the heat pump (790 kWh), refrigerant machine (329 kWh) and ancillary units (2.146 kWh).

Ventilation: High efficient circulating heat exchanger (83% heat recovery); Comfort optimization with metering the air quality and humidity regulation (during winter – humidification; summer - dehumidification). Raising the temperature of the brine results to a higher efficiency of the heat pump by 15% (COP-Raising), Storage mass sub situation with PCM-Material results to lower temperature peaks during summer, Active PCM storage mass removable with night lowering and ventilation air support., Soil collector cooling instead of ventilation cooling reduce the electricity demand by 70%. Exhaustion of the waste heat of the lighting system, Regulation of the fresh air with a CO<sub>2</sub> sensor reduce the electricity of the ventilation by 30%.







## Paronet 8

Sweden

A heating central will be planned in floor 1. Heating will be supplied from the municipal district heating system that heats the building mainly with radiators with thermostatic valve. Outside the main entrance is planned about 160 m<sup>2</sup> of ground heating.

A cooling central will be planned in floor 1. Cooling will be supplied from the municipal district cooling system, which cools outdoor air in the air handling units and active cooling beams placed in the ceiling void of the offices and conference rooms which are controlled via stand-alone control equipment mounted on the cooling beam. Process cooling in server rooms are planned with fancoils. Free cooling for the cooling system of active cooling beams are planned via a separate free cooling coil in air handling units.

Plant for air-handling will be placed on the roof floor 9 comprising six separate units, each with filters, cooling-recovery, rotary heat exchangers, heating coils, cooling coils and fans.

Treated air will be supplied to the offices via active cooling beams and air-extract will be placed centrally and in pantries and restrooms. Boost ventilation in conference room starts and stops by time switch. Car park will be ventilated by the building's exhaust air intermittently and starts and stops by the signal from the presence of controlled lighting.



### Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**144,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**74,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

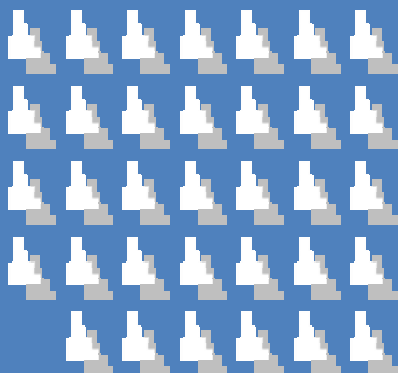
**48,6%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishments

*Type of building:*

**Office**



Brostaden owns a total of 98 buildings (517 000 m<sup>2</sup>) of which 9 are completely run and financed by the leasing customers. Thirty-four of the buildings meet the GreenBuilding standards, which is 33,6% of the total amount of buildings or 37% of all buildings excluding the ones fully leased by customers. Brostaden's mean energy use for electricity and heating was 128 kWh/m<sup>2</sup> (for about 400 000 m<sup>2</sup>) in 2007.

Fastighets AB Brostaden has been working with energy optimisation and energy conservation for a very long time and is continuously working with refurbishing their buildings to reduce the energy use. In many buildings they have exchanged windows, installed district heating and/or cooling, and in some buildings they have focused on exchanging the building automation systems, optimising the operational hours and thus the energy use.

Some of these buildings are:

Alphyddan 11; Domnarvet 39;  
Ekenäs 1, 3; Ekstubben 21, 22a,  
22b; Godståget 1; Haifa 1;  
Hästholmen 2; Karis 3, 4; Linde  
Torp 8; Mästaren 1; Renseriet  
25; Sicklaön 393:4, 394:5;  
Stensätra 7; Tidskriften 2;  
Tjurhornet 15; Torngluggen 1;  
Veddesta 2:19, 2:21, 2:22, 2:23,  
2:50; Hammarby Smedby 1:454

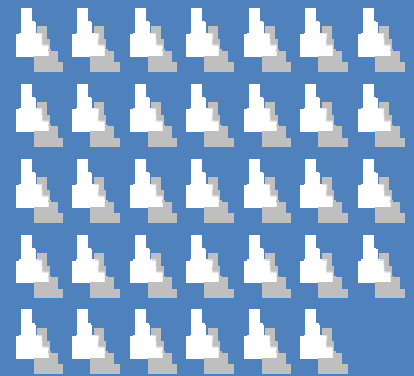
*Sweden*

## Fredsfors 14

*Stockholm, Bromma, Sweden*

Brostaden has converted the heating of **three** buildings from oil to gas. Additionally the exhaust gas is used to preheat the water in the radiator circuit.

Brostaden is a property owner working with energy efficiency in various ways. One step to become more environmentally friendly has been to convert from oil heating to gas heating. Although, before converting to a new boiler other measures were implemented to minimize the size of the new boiler. The first measure implemented was to install a modern control unit. Secondly recommissioning of the heating and cooling systems were completed. When these two measures were completed oil heating was converted to gas heating, with exhaust gas condensation. The energy in the exhaust consists of heat and steam. The steam is produced during the combustion in the fuel. The exhaust gas is cooled by the return of the radiator circuit. The water in the radiator circuit is then preheated before entering the boiler. Consequently less gas is needed to heat the water in the radiator circuit to the required temperature.



### Refurbishment

*Type of building:*

**Office**

*Area:*

**15.105 m<sup>2</sup>**

*Before refurbishment:*

**200,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**125,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**37,5%**





## Refurbishment

*Type of building:*

**Industrial**

*Area:*

**10.000 m<sup>2</sup>**

*Before refurbishment:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**>25%**



## Rosersbergs chocolate warehouse

*Rosersberg, Sweden*

A company selling chocolate had some problems with the storage of their products. The problem was during hot summer days when the temperature in the warehouse increased considerably and the high quality of the chocolate could not be kept.

The property owner Brostaden had good experience from working with summer night cooling and suggested this solution to the chocolate company. Summer night cooling means nighttime ventilation of the building to cool the structure and products. Since the building is situated in an industrial area it was not disturbing to install a really large propeller fan and roof hatches. The fan capacity is about 7000 m<sup>3</sup>, which corresponds to 1 air change per hour. The system is regulated with temperature sensors. The fan is operating until the indoor temperature is 18°C, thus the temperature will be kept below 23°C in daytime. Both the property owner and the tenant are satisfied with the result and **4** warehouses, in total about **10.000 m<sup>2</sup>**, have now installed summer night cooling.



## Vallonsmidet 8

*Bromma, Sweden*

The building will change heating system from oil to heat pumps with heating and cooling ground storage. Both for heating and cooling the efficiency factor is 3,5, i.e. for 1 part electricity 3,5 parts heat or cold is produced.

Additionally it can be said that it is the cooling load that has set the dimensions for the heat pumps. The heat production can be larger than needed for the 2 buildings. Therefore the third building on the premises can be connected to the heat pumps in the future and another oil furnace will be replaced. Although this measure is not included in this project.

There has been a significant decrease in energy consumption for heating thanks to implementation of a new control system.



### Refurbishment - 2007

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**1.835,00 kWh/yr**

*Primary energy demand:*

**594,00 kWh/yr**

*Energy savings:*

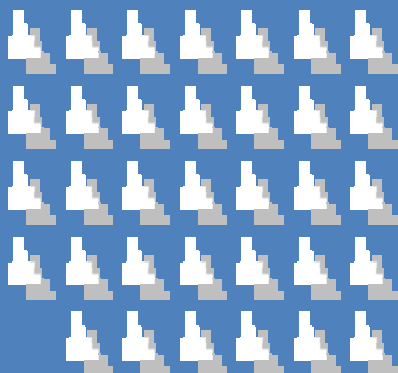
**67,6%**





**BROSTADEN**

ETT FÖRETAG I CASTELLUMKONCERNEN



## Refurbishment - 2007

*Type of building:*

**Office**

*Area:*

**8.460 m<sup>2</sup>**

*Before refurbishment:*

**170,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**80,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**53%**



## Getholmen 1

*Stockholm, Sweden*

To achieve energy savings following solutions were realised:

Building envelope: Concreat external walls with 100 mm isolation and metal shielding; Concreat ceiling slabs and floor slabs; Windows with 3 pane glazing.

Installations: Heating: District Heating; SHW: Hot water is made by the district heating; Ventilation: Variable Air Volume; Lighting: Flourescent and Compact Flourescent; Electricity: Renewable 100% Hydropower.







## Ödman 15

Växjö, Sweden

Corallen regularly follows up on utilities consumption, e.g. water and energy use. We use an operations follow-up programme (WebEss 200) for supporting this endeavour.

All of our metres are read monthly. Metre values are registered and analysed. Deviations are investigated and dealt with continuously. An additional objective is to evaluate improvement measures.

Additionally, a monthly survey of technical installations is completed according to a specialised template. Before the survey is begun, tenants are contacted in order to capture any possible deviations in the interior climate.

The results of the survey are then followed-up in monthly meetings where Corallens operations staff and operations entrepreneurs participate. During these meetings, we follow up on and make adjustments to the operation of the properties, control operation times, the degree of efficiency of the recycling systems, etc, plan additional improvement measures, e.g. adjustment of air flow in response to operational changes.

Corallen also works with yearly environmental goals aimed at energy conservation and have been issued an environmental diploma based on Swedish environmental standards.



### Refurbishment - 2007

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**159,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**101,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**36%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**21.604 m<sup>2</sup>**

*Reference value:*

**124,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**85,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**31,4%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Lindholmspiren, 3

*Göteborg, Sweden*

The heating and cooling energy supplied to the building is the district heating and cooling. Heat is distributed in the building via air-conditioning and via radiators.

Cooling energy is distributed to floors one and two via air-conditioning, to floors three to six additionally in a combination with water chilled beams. The ventilation system consists of four airhandling units that supply the building with an average air flow volume of 0,7 l/s and m<sup>2</sup>. The air flow rate is controlled by a variable air flow control strategy (VAV) on floors one and two. The flow rate is load-controlled with respect to indoor temperature. Air flow on floors three to six is controlled by constant strategy (CAV). All fans in the air-conditioning system are designed for possibility to modify the operation conditions with respect to actual loads.





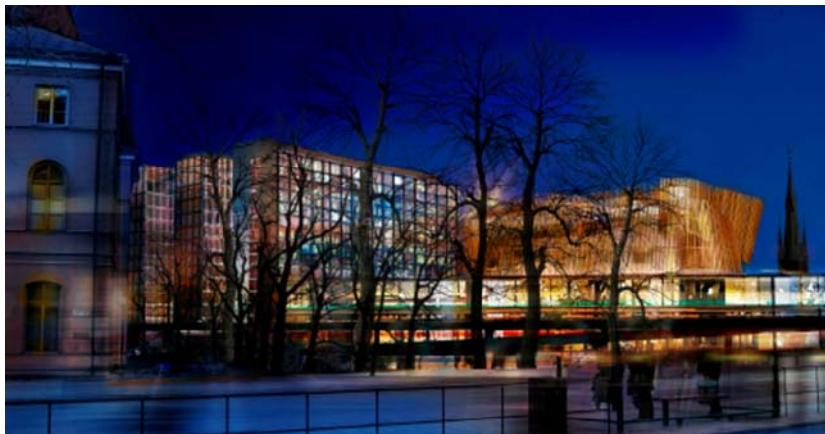
## Stockholm Waterfront Congress Centre

*Göteborg, Sweden*

Free cooling will be installed. Heating is done through a recycling system and use of heat from a nearby lake.

District heating will be partly used. The ventilation is controlled by variable air flow control strategy to reduce the use of energy and ensure that all areas get fresh air. Air will be used to recycle sunheated areas.

Bangårdsposten will install a computerised control system that will document energy use in the building. Flaws in the system will be reported.



**New - 2010**

*Type of building:*

**Commercial**

*Area:*

**70.000 m<sup>2</sup>**

*Reference value:*

**145,50 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**59,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**59,4%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment

*Type of building:*

**Educational**

*Area:*

**19.380 m<sup>2</sup>**

*Before refurbishment:*

**440,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**319,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**27,5%**

*Investment:*

**808.574 €**

*Annual savings:*

**185.100 €/yr**

## Kinder-, Jugend- und Familienzentrum

*An der Wuhlheide 197, 12450, Berlin, Germany*

The FEZ-Berlin is the biggest, non-profit-making children and family recreation centre in Europe.

The heating system of the FEZ Berlin was completely renewed, that means that a central building control was installed, which controls the temperature of single rooms according to the demand. The ventilation system was generally refurbished as well.

A frequency converter as well as the modern control system reduces demand of heat and electricity.

The conventional lighting was replaced by modern T5-lamps.

The swimming pool of the FEZ Berlin was outfitted with a water treatment equipment to reduce the demand of fresh water.





## Tullgården 2

Sweden

A plan for energy reduction has been developed where focus is on cooling and ventilation:

New ventilation units (FTX) with frequency transformers and new control and regulation equipment. Replacing an old cooling unit with a new one. Rebuilding the seawater cooling system with free cooling function.

Other implemented measures: Our Greenvision consists on reducing indoor temperature, reducing runtime for certain ventilation units. attend to heat exchanger LB08, reducing the sauna units runtime, adjust runtime temperature for ground source heat, pool cover, ventilation (heat exchange and runtime) and lighting (runtime).

Folksam has a well developed energy management system, with regular statistics and reporting and with a long term leased energy expert especially hired to deal with energy and environmental issues.



### Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**101.974 m<sup>2</sup>**

*Before refurbishment:*

**127,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**86,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**32,4%**

*Investment:*

**808.574 €**

*Annual savings:*

**185.100 €/yr**





## Refurbishment - 2008

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**203,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**108,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**46,8%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Manfred 7

*Sweden*

The energy reduction mainly refers to the following implemented measures:

Optimization of the ventilation units operation time; Reduction of the airflow with 15-40 %; Reduction of indoor temperature, now between 15-18 °C; Increased heat exchange efficiency; New computerized control system



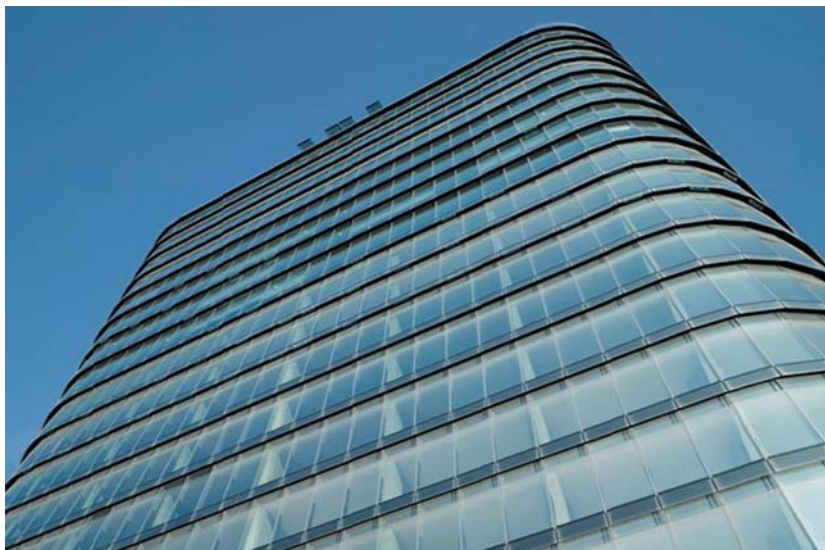


## Sign-Hafenoffice

*Speditionsstraße, 40221 Düsseldorf, Germany*

To achieve energy savings following solutions were realised:

Heating: Optimisation of the regulation; Cooling: Alternative Equipment strategies – District or Block cooling; Lighting: Selection of energy efficient lamps and Control Systems; Electric equipment: Selection of energy efficient equipment; Management: Monitoring energy consumption with a Building Energy Management System (BEMS) and fine tuning of controls through BEMS.



**New - 2010**

*Type of building:*

**Office**

*Area:*

**11.839 m<sup>2</sup>**

*Reference value:*

**301,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**174,50 kWh/m<sup>2</sup>yr**

*Energy savings:*

**42%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**9.181 m<sup>2</sup>**

*Before refurbishment:*

**200,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**103,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**48%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Friesenquartier Building FQ 22

*Im Klapperhof, 50670 Köln, Germany*

To achieve energy savings following solutions were realised:

Usage of joint district heating with good efficiency based on combined heat and power generation (CHP) and energy-efficient technical equipment. Usage of high efficient equipment with heat recovery system. Reduction of the cooling energy demand by using an ice storage system.

Installation of efficient lightning systems with electronic power supply units and additional equipment such as presence detector.

Controlling and operating the systems for heating, cooling, mechanical ventilation systems, and electrical systems with DDC (Direct Digital Control).

Insulation of the building envelope as much as possible according to the preservation order. Installation of high quality sunblind at the outside of the new windows with heat protection glass for summer heat protection.

## Edifício Sede e Museu buildings

*Av. Berna, 45A, 1067-001, Lisboa, Portugal*

For the reduction of energy consumption a campaign was organised to raise awareness among Foundation employees of the “rational use of energy”. Among other initiatives, people were encourage to: Turn off office light when absent; Turn off computers at the end of the day; Use stairs to go up or down two floors, instead of using elevators... Also routines were implemented in order to monitor the necessity of illumination in different periods of the day and hot and cold water pipes were changed in order to avoid losses in the pipes.

A detailed efficiency study on the “heat-recovery chiller” was carried out which showed the system can be used at all times, thereby increasing the recovery of heat from the chiller system and improving energy efficiency;

Presence detectors in underutilized spaces were installed, while the number of electric circuits were raised in order to divide the illumination circuits; Light levels in the corridors on the different floors were decreased to an acceptable level; The lighting of large spaces like auditoriums and meeting rooms became regularly checked. Incandescent lights were replaced by energy-saving lights; Wherever possible more efficient equipment was installed. The headquarters facade was illuminated using LED technology;

Centralized electrical management systems were installed and Energy efficiency requirements were introduced in the Central Air Conditioning and other heating systems.



**New - 2009**

*Type of building:*

**Institutional**

*Area:*

**77.800 m<sup>2</sup>**

*Reference value:*

**176,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**119,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**32,4%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2005

*Type of building:*

**Health**

*Area:*

**11.264 m<sup>2</sup>**

*Before refurbishment:*

**265,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**140,50 kWh/m<sup>2</sup>yr**

*Energy savings:*

**47%**

*Investment:*

**303.800 €**

*Annual savings:*

**17.000 €/yr**

## Hospital del Oriente

*Urbanización Castañera, S/N, 33540, Arriendas, Spain*

The Direction of the foundation "Francisco Grande Covián" of the Hospital of Orient of Asturias started in 2005 with the development of an action line aiming at promoting the use of renewable energies in order to gradually reduce the building greenhouse gas emissions.

On this matter, the following actions have been / will be developed with the final objective to cover 100 % of the energy demand of the building with renewable energy sources.

The supply of electrical energy has been contracted to the unique Spanish company commercializing 100 % electricity from renewable energy sources.

225 m<sup>2</sup> solar thermal panels have been installed to reduce the fossil fuel consumption for domestic hot water preparation and heating of the centre.

The installation of BIOMASS boilers is planed to begin at the end of 2006 to progressively substitute the use of fossil fuel with natural fuel. The building, with an effective area of 11.264 m<sup>2</sup>, contains a hospital of 80 beds as well as an area for external consultation.





## Ormen 1

*Hummergatan 3, Luleå, Sweden*

The restoration includes the following measurements:

Conversion from electrical heated radiators to new water heated radiator system with modern regulation.

Connection to district heating system.

A new modern lightning system has been installed.

The ventilation has been completed with a heat exchanger.



### Refurbishment - 2006

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**170,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**97,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**43%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment - 2008

*Type of building:*

**Office**

*Area:*

**15.210 m<sup>2</sup>**

**9.714 m<sup>2</sup>**

*Before refurbishment:*

**169,1 kWh/m<sup>2</sup>yr**

**162,9 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**119,8 kWh/m<sup>2</sup>yr**

**109,4 kWh/m<sup>2</sup>yr**

*Energy savings:*

**29%**

**33%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Kv. Siktet 5, Hus 1

*Sweden*

## Kv. Siktet 5, Hus 2

*Sweden*

During the modernization of the building the facades insulation has been improved with 95 mm mineral wool. Existing windows have been replaced with new aluminium framed windows with double insulating glass units. Windows facing south and west have solar control glass.

All fan coil units and radiators have been replaced, with exceptions for the garage floors and some premises occupied by sitting tenants. The air handling units were installed in 1998. All units have heat recovery, heating battery, cooling battery and pressure controlled fans equipped with frequency converters. All air handling units have undergone service and calibration during the rebuilding. The common district heating central of the two buildings has been updated with new pumps and valves. In order to easily follow up the energy use in the buildings, separate meters for each house will be installed to measure district heating and electricity.

The Building Management System has been replaced and improved.





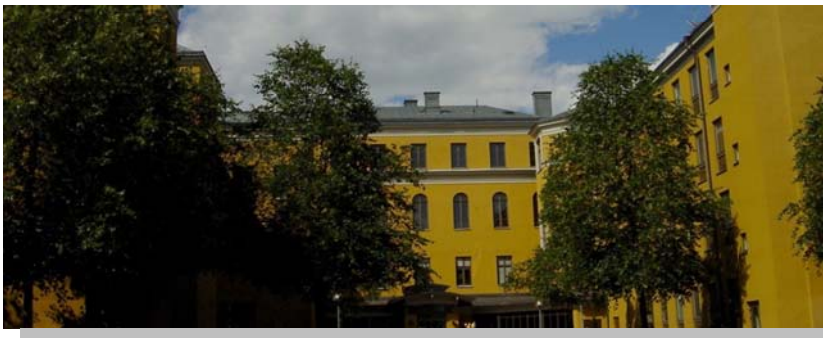
## Stadshuset

Sweden

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

New heat exchangers for heating, ventilation and domestic hot water. Also new steering valves, new expansion vessel, new pressure controlled circulation pumps for the heating and ventilation circuit. The whole system will now be controlled and optimized from new control systems. The heating need of the facility has changed from being provided through the ventilation system to, instead, be supplied from the radiators. That also means that the hours the air handling units are running are decreased, mostly during early mornings. Five of the air handling units are of the type that are pre heating through rotating heat exchanger wheels. They also do the final heating of the supply air into zones with different supply air temperatures. To optimize the heat recovery the settings are changed to make sure that the lowest of the desired values from now on is the one that is controlling the heat recovery system.

Redesign the controlling functions for the snow melting system, including external controls. New software for controlling six of the ten air handling units. Function control, taken into operation, parameter settings and optimization of all radiator thermostat valves is done. Installation of new water saving equipment in water closets, sinks and showers.



### Refurbishment - 2008

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**256,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**191,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25,4%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2007**

*Type of building:*

**Office**

*Area:*

**1.089 m<sup>2</sup>**

*Reference value:*

**88,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**33,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**62%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Passive House office building

*August-Braun-Str. 1, D - 88239 Wangen, Germany*

The Brothers Karl and Jakob Immler have been working in the building and construction industry for more than 30 years. In those 30 years the company always adapted flexible and in time to new market situation.

Part of this is that buildings are being built with a higher energetic quality than required by legal standards. For the Brothers Immler sustainability and enhancement in value is always an important issue.

Constructing a non-residential building according to the Passive House concepts bears still a lot of uncertainty for the owner or investor. Vision and courage are needed to do more than legal standards require and confident building owners and elaborate building concepts are necessary.

The Passive House office building in Wangen demonstrates that it is possible to do those tasks and that it is economically feasible as well.

Measurements performed include High efficient condensation boiler, Façade with thermal insulation composite system 24cm, Roof with thermal insulation composite system 22 - 24cm, Triple pane insulation windows, Energy saving light bulbs, Ventilation system with heat recovery (80%), The building achieved passive house standard through high air tightness of the building envelope with highly insulated construction components.



## Discount store "Takko"

*Künkelinstraße 14, 88299 Leutkirch, Germany*

For most building owner of non-residential buildings a sustainable energy concepts means a step into the unknown. Convinced building owners that are visionary and have courage as well as an intelligent building concept are therefore needed to exceed minimum standards. That is possible and economically available as the realization of the discount store "Takko" shows.

In the process of planning the building owners decided to go for an energy efficiency concept. The one story building has an amoured concrete frame. The facade is made of porous concrete. The basement is insulated with 10 cm Polysterol. The roof has a 18 cm mineral wool insulation.

Heat is provided by a geothermal heat pump and a ventilation system with heat recovery of 60%.



**New - 2007**

*Type of building:*

**Commercial**

*Area:*

**1.089 m<sup>2</sup>**

*Reference value:*

**88,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**45,20 kWh/m<sup>2</sup>yr**

*Energy savings:*

**48,6%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2005**

*Type of building:*

**Office**

*Area:*

**10.000 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**32,5 kWh/m<sup>2</sup>yr**

*Investment:*

**155.000 €**

*Annual savings:*

**32.500 €/yr**

## New central office building

*85 Mesogeion Avenue, 11526, Athens, Greece*

GEK S.A. is one of the four major construction groups in Greece. In its new central office building, the energy efficiency measures that were applied, have led to significant reduction of energy consumption in comparison to conventional buildings.

Heat recovery from conditioned air stream mechanically exhausted from the building. Additionally heat recovers from one of the Heat Pumps of the building (heat riser). The system recovers hot water (while producing cold water) that is used for heating up the building during mid-seasons between winter and summer.

VSD: Installation of frequency inverters to all the motors (fans, pumps, etc.) concerning the building air-conditioning, thus all the equipment is consuming power proportional to the process demand of the building at any time.

Window shades: Regulated venetian blinds in the internal space.

Building Management System: Installation of BEMS. Monitoring the indoor temperature, humidity, people presence and controlling relevant subsystems (heating-cooling, lighting). Power factor correction. Add capacitor systems at the main electricity board.



## School building

*Karlovac Count, Croatia*

The building is heated through its own central boiler with hot water radiator system with daily interruptions for a period of 14 hours intermittent over the weekend of 48 hours.

In all the facilities it has been replaced the roof coverings and metal ware. In the old part of the school, the greater part of external doors and windows were replaced. Replacement of facade joinery included the following types of work: replacement of external joinery on the newer building, replacement of remaining old external joinery on the older building and closing connecting corridor between the old and new part of the school.

In scope of the modernization of heating systems, included replacement of regulation valve, circulation pumps, reinforcement and connections, and installation. The change of old radiator valve with new thermostatic is made.

In scope of electrical lighting modernization, were installed fluorescent lighting fixtures with electronic ballasts and lamps with energy saving bulbs.

(In Croatia there are no legal values for primary energy and all calculations and comparisons were made based on heat energy demand.)



### Refurbishment - 2008

*Type of building:*

**Educational**

*Area:*

**2.570 m<sup>2</sup>**

*Before refurbishment:*

**158,36 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**96,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**39%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2010

*Type of building:*

**Educational**

*Area:*

**1.712 m<sup>2</sup>**

*Before refurbishment:*

**71,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**42,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**41%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Grundschule Haarhausen

*Haarhausen 22, 42279 Wuppertal, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Wood pellet boiler (95 kW): Heat generation for the school building with wood-pellet boilers, power about 95 kW. The existing low-temperature exhaust of the oil boiler, after a check, could also be used for the operation of the biomass boiler. Use of high efficiency pumps. For the classroom, a supportive mechanical ventilation is provided (hybrid ventilation concept).

20 cm insulation panel (façade), 40 cm insulation panel (roof), vacuum insulation panel (cellar) The school receives a new exterior wall round wear. The existing wooden windows and the washed concrete curtain wall panels are removed and the remaining reinforced concrete skeleton with a new insulated air-tight envelope enclosed. Roof and floor plate will also receive a new insulation. The existing canopies over the entrances will be removed. In the entrances and the multi-purpose rooms a canopy for weather protection and sun protection will be installed. The canopies are made of a steel structure parallel to the facade which will be running close to a row of wooden slats that are mounted between the flanges of the steel sections. The canopies will receive a top side translucent cover plates with double-bridge-Stop.







## Building

*Piraeus, Greece*

Based on the principles of sustainable architecture, solar spaces are installed at the South-East elevations of the building, consisting of a double layer of windows with a U-value of 1,2 W/m<sup>2</sup>K and replacing the existing single-glazed "curtain wall" façade of 5,4 W/m<sup>2</sup>K. On the north-west elevations, the existing "curtain wall" facades have been replaced with new double glazed Argon filled ones with a U-value close to 1.4 W/m<sup>2</sup>K. Installation of an external shading system of (fixed) aluminum louvres at the proper angle for maximum solar gains in the winter and solar protection during the summer.

Motorised dampers electronically controlled have been installed on all the facades of the building, including those of the atrium and in the solar spaces, in order to allow the passive night ventilation and cooling of the internal spaces during the summer. This takes advantage of the diurnal temperature range that appears in the Piraeus area.

New luminaries with electronic ballast, and dimmable ones close to natural light area.

Installation of a computerised central control system (only on/off) for both artificial lighting and air-conditioning (fan coils). Electronic time control of the passive ventilation dampers is included in the central control system as well as for artificial lighting.



## Refurbishment

*Type of building:*

**Office**

*Area:*

**3.500 m<sup>2</sup>**

*Before refurbishment:*

**191,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**131,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**24%**

*Investment:*

**175.000 €**

*Annual savings:*

**23.100 €/yr**



## Refurbishment - 2009

*Type of building:*

**Educational**

*Area:*

**1.966 m<sup>2</sup>**

*Before refurbishment:*

**424,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**81,30 kWh/m<sup>2</sup>yr**

*Energy savings:*

**81%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Grundschule Marktbreit

*Fleischmannstraße 3a, 97340 Marktbreit, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: ground water heat pump 50 kW; system temperature: 35/25 with panel heating.

Cooling: passive cooling via panel heating system and ventilation.

Ventilation: ventilation system with heat recovery  $\geq 80\%$ .

Lighting: fluorescent light bulbs with ballasts.

Building envelope: 20 cm mineral insulating board;  $U = 0,19 - 0,33 \text{ W/m}^2\text{K}$ ; Windows: triple-pane-windows,  $U = 1,00 \text{ W/m}^2\text{a}$ ; Roof: 20 cm mineral wool;  $U = 0,19 \text{ W/m}^2\text{K}$ .



## Offices - Building 6S

*Stavanger, Norway*

On our actionlist we have planned to install building automation system for controlling all the ventilations systems (20) and establish a more professional system for following up the energy consumption for each building.

Other technologies implemented: heat recovery, water based heating, LED lighting, moving sensors and temperature reduction.



### Refurbishment - 2008

*Type of building:*

**Office**

*Area:*

**28.588 m<sup>2</sup>**

*Before refurbishment:*

**217,40 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**173,90 kWh/m<sup>2</sup>yr**

*Energy savings:*

**20%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

*Harry Sjögren AB*



**Refurbishment  
2005 -2008**

*Type of building:*

**Commercial**

*Before refurbishment:*

**15.515.051 kWh/yr**

*Primary energy demand:*

**10.869.317 kWh/yr**

*Energy savings:*

**30%**



Harry Sjögren is continuously working with refurbishing their buildings to reduce their energy consumption. In many buildings they have exchanged windows, installed district heating and/or cooling, and in some buildings they have focused on exchanging the building automation systems, optimising the operational hours and thus the energy use.

The buildings where they have awarded the GreenBuilding Partnership are:

Ängsviolén 1; Skinntickan 1;  
Generatoren 2; Syrgasen 8;  
Potttegården 4; Gaslyktan 11;  
Anisen 3; Tjärblomman 3;  
Tulpanen 1; Tusensönan 2;  
Törnrosen 3; Vallmon 2,3,6,7;  
Berguven 1; Varla 2:380, 2:388;  
Kungsbacka 4:47; Hede 3:127,  
3:131; Riskullaverket 2;  
Hönekulla 1:571; Kobbegården  
6:180, 6:360, 6:362, 6:724,  
6:726; Högsbo 20:22, 24:12,  
27:7, 28:3, 36:9, 38:9, 40:1; Rud  
51:21; Konfektasken 15; Stallet  
3; Karsossen 3; Flaggan 1

*Sweden*



# Harry Sjögren

AB

*Harry Sjögren AB*



**Refurbishment  
2005 -2008**

*Type of building:*

**Commercial**

*Before refurbishment:*

**15.515.051 kWh/yr**

*Primary energy demand:*

**10.869.317 kWh/yr**

*Energy savings:*

**30%**





## Refurbishment 2005 -2008

*Type of building:*

**Commercial**

*Before refurbishment:*

**15.515.051 kWh/yr**

*Primary energy demand:*

**10.869.317 kWh/yr**

*Energy savings:*

**30%**



Energy concept varies from building to building.

Harry Sjögren is working in a very organised and strategic manner to ensure that energy utilisation in their buildings is optimised: they measure their energy use on a monthly basis, regularly follow their Customer satisfaction index, and have yearly energy audits.







## Passief kantoor

*Kennedylaan 32, 9000, Gent, Belgium*

The building was constructed according to the 'Passive house' concept, thus: very good insulation of the building envelope e.g. wall insulation of 25-30 cm and roof insulation > 30 cm, very airtight building envelope, heat recovery with a high efficient heat recovery unit, via mobile external sunshading, a good summer comfort can be realised without active cooling.

The office is a certified for the "passive house" standard. It uses 66% less energy than is prescribed by the Belgian (Flemish) energy legislation.

The energy consumption of the building is followed up via a professional energy monitoring system.



**New - 2009**

*Type of building:*

**Office**

*Area:*

**1.800 m<sup>2</sup>**

*Reference value:*

**276,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**92,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**66%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment – 2010

*Type of building:*

**Office**

*Area:*

**4.140 m<sup>2</sup>**

*Before refurbishment:*

**165,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**37,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**77%**

*Investment:*

**n/a**

*Annual savings:*

**10.000 €/yr**

## Headquarters

*Geitlingstr. 20, 47228, Duisburg, Germany*

The following measure for improving energy efficiency have been implemented in 2000 - 2005: Installation of an under-floor heating in the entire building complex. Utilization of heat recovery from the cooling systems of the nearby Energy Food Town building to replace nearly the total heat consumption of the installed gas boiler. Every working place is equipped with LCD monitors. Generally the power management is installed and initialised. All rooms are equipped with CFL or efficient fluorescent lamps with electronic ballasts. The outdoor lighting is controlled with motion detector and photoelectric switch.

The following measures will complete the savings for 2010: The 12 decentralised electric warm water boilers in the toilets will be removed, so that only cold water is provided. The boilers in the kitchen will be controlled by a clock timer. The lighting in the corridors will be combined with push buttons. Within the procurement of IT devices efficiency requirements will be implemented. The temperature in the air conditioned conference rooms will be adapted and the switch off after meetings will be checked regularly. The vending and coffee machines will be combined with a manual switch off to reduce energy consumption at night and week end. A so called "Environmental Lightning" will be introduced, who checks regularly possible efficiency deficits. In an energy week all employees will be informed and sensibilised about energy saving in every day life, exemplarily in lighting and IT switch-off and reduction of private uses.





## Haus der Ingenieure

*Raiffeisenstraße 32, 8010 Graz, Austria*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: heat pump brine/water, with 14 drillings 150m depth each and concrete core heating. Free cooling, highly efficient A/C system, use of heat-pumps (sources: geothermal energy and ground wa-ter), cooling ceilings, efficient pumps and regulation..

Lighting: energy efficient fluorescent lamps.

Building envelope: Optimization of building envelope.



**New - 2010**

*Type of building:*

**Office**

*Area:*

**2.900 m<sup>2</sup>**

*Reference value:*

**37,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**26,50 kWh/m<sup>2</sup>yr**

*Energy savings:*

**30%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment – 2005

*Type of building:*

**Office**

*Area:*

**1.542 m<sup>2</sup>**

*Before refurbishment:*

**220,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**70,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**68%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Office building

*Koprivnica, Croatia*

In existing office building built in 1968, energy audit determined yearly heat energy demand of 220 kW/m<sup>2</sup>a. In the reconstruction of the building, measures of energy efficiency included thermal insulation of building envelope with 10 to 14 cm insulation and elimination of thermal bridges, change of windows with microswitches for local control of heating/cooling system and use of 4 pipe fan coil system for heating and cooling. Total heat energy demand after reconstruction is lowered to 70 kW/m<sup>2</sup>a.

(In Croatia there are no legal values for primary energy and all calculations and comparisons were made based on heat energy demand.)





## Nap Hotel

*C/ José Ramón Zaragoza, 6, Oviedo, Spain*

Lightweight structure using expanded polystyrene. In this way it is achieved that lightening and insulation elements are incorporated into the bottom of the structure of the slab, providing the same additional intrinsic thermal insulation. Ventilated façade system incorporating HERCA own designed solar collector with solar tracker. It incorporates photovoltaic panels with self-designed monitoring built into the structure and integrated into the design of the facade. Exterior carpentry with thermal break and glass losses coefficient  $K_g = 0.70 \text{ W / m}^2 \cdot ^\circ \text{C}$ .

Lighting and low-consumption appliances and lighting control.

Using solar thermal (300 m<sup>2</sup> of solar collectors on roof) with solar collectors with vacuum tubes. Photovoltaic solar energy (panels integrated into the south facade) with thin film technology and BIPV solar tracker aesthetic inclination, (100 m<sup>2</sup>), for their own use of the hotel. Harnessing wind energy by installing wind turbines on the roof of the building for their own use of the hotel. Using recycled water and rain, taking the height of the building and jump, and installing a micro hydro plant for electricity generation for own use.

In the distribution system and ventilation heat recovery will be installed to prevent and recover lost 30% of thermal energy than conventional systems discharged directly.



**New - 2008**

*Type of building:*

**Hotel**

*Area:*

**2.500 m<sup>2</sup>**

*Reference value:*

**403,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**181,30 kWh/m<sup>2</sup>yr**

*Energy savings:*

**55%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New – 2009**

*Type of building:*

**Office**

*Area:*

**1.485 m<sup>2</sup>**

*Reference value:*

**241,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**77,40 kWh/m<sup>2</sup>yr**

*Energy savings:*

**68%**

*Investment:*

**285.000 €**

*Annual savings:*

**23.419 €/yr**

## Exhibition and Office Building

*Vahrenkampstr. 12; 32278 Kirchlegern, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating and hot water production: Connection to an efficient local heat net with CHP; panel heating with low temperature level, solar warm water heating.

Air conditioning & Ventilation: Heat exchanger in ventilation with about 80 % efficiency, variable volume flow rate in dependence of presence.

Lighting: Energy saving lighting systems, daylight and motion detectors, LED technology.

Central Building Control System: Single room control with visualization and central control.





## Smarthouse

*St.Martin-Strasse 57, 81669 München, Germany*

Rising energy prices is not interesting for the "smarthouse": Everything is prepared to save energy and to use the existing resources more efficiently.

The ground's natural temperature is used to warm the building in winter and to cool during the summertime. With thermo active ceilings and walls the temperature in the offices can be regulated without using much energy. For this the groundwater with its stable temperature is used.

The energy effective façade secures that in the winter the favourable heat does not leave the building and that in summer an undesirable heating of the building is prevented. Environmentally friendly district heating completes the energy concept.

Main measures implemented: Building envelope: highly insulated façade and improved glazing; Heating: district heating based on cogeneration of heat and power; Renewable Energy Sources: use of groundwater as geothermal heating and air conditioning; Lighting: daylight control; ventilation: heat recovery; partial ventilation system



**New - 2009**

*Type of building:*

**Office**

*Area:*

**22.833 m<sup>2</sup>**

*Reference value:*

**215,50 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**100,90 kWh/m<sup>2</sup>yr**

*Energy savings:*

**53,2%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New – 2009**

*Type of building:*

**Office**

*Area:*

**40.000 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**52 kWh/m<sup>2</sup>yr**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Marximun

*Modecenterstrasse 17-19, 1110, Vienna, Austria*

The actual building concept will lead to a very comfortable indoor climate. The existing concept exceeds all the appropriate national and European norms and guidelines, sometimes significantly. The user can adjust the individual room temperature set point via his room control device  $\pm 3^{\circ}\text{C}$  differing from the ideal room temperature. The sunscreens on the outside of the windows, which also act as a glaze cover can of course also be operated manually. Because of the floor and ceiling tempering a maximum user comfort is assured. Air ventilation will be via manually openable windows, according to user request. Heat recovery and low temperature techniques are used. According to the integrated energy concept, the costs for heating and cooling can be kept below  $3\text{€}/\text{m}^2$ . The buildings are characterised by future proof, energy efficient and environmental friendly construction. Good thermal insulation, compact design and efficient technical equipment is combined with environmental friendly and resources saving district heating. 2/3 less CO<sub>2</sub>-emission than a comparable modern building and less than 50% compared with the LEED building standard tells its own tale.





## Hofer St.Margarethen

*B86 Feldbacherstraße an der Raab, A-8321  
St.Margarethen, Austria*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: Heating pump, Highly efficient control and regulation system.

Lighting: Only highly efficient lamps used.

Ventilation: Free cooling, Combined system with the heating pump.

Others: Optimization of the building envelope, Permanent sun shading .

Heating and cooling demand calculated according to OIB Richtlinie 6 (EPC).



**New - 2009**

*Type of building:*

**Commercial**

*Area:*

**1.217 m<sup>2</sup>**

*Reference value:*

**78,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**40,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**44,7%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment

*Type of building:*

**Health**

*Area:*

**n/a**

*Before refurbishment:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**>25%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Ámbitos Caleta y Cartuja

*Granada, Spain*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Implementation of the CHP for power and thermal energy for buildings located in the Caleta and the Center Licinio de la Fuente. This action of centralization and switch to natural gas has led and will involve the environmental level: air emissions from combustion are free of smoke and waste, sulfur content is virtually zero and reduce the emission of CO<sub>2</sub> into the atmosphere, a reduction of installed power, the total utilization of waste heat from CHP groups, the location of all heating and cooling generators in a unique building outside the buildings for hospital use, thereby reducing disaster risk and a complete substitution of diesel by Natural Gas.

Implementation of a plan of gradual replacement of low luminaires in all hospital centers and the installation of sensors on/off in some areas, all within the Green-Light European program with what is being improved lighting in the Hospital is decreasing consumption.







## Hotel am Stadtpark Hilden

*Klotzstraße 22, 40721, Hilden, Germany*

First the heating system was refurbished and a new boiler was installed. The hotel decided to install a condensing boiler with high efficiency. By improving the whole heating system, the connected power could be reduced by 60%. New heating-pumps has been installed which can be controlled electronically. Therefore it was possible to reduce the power-density of the pumps by 90%. A digital control system was installed. Old ventilation systems which were oversized and not yet necessary has been shut down.

By refurbishment of the hot-water-system the boiler could be minimized by 80%. This could be achieved by modernisation of the shower-heads, by adoption of perlators which had the impact on the hot water system the flow rate could be reduced by about 40%. The heating pipes as well as the hot water pipes and the fittings were insulated to reduce the energy losses.

Within the new building (construction year 2000) new T5-lamps were installed which can be dimmed and which are controlled by the digital-control-system. In the older buildings the old lamps and lights has been replaced by new low-energy lamps. The new building where the conference room is situated was built in low-energy-standard with a high standard of technology in energy supply.



### Refurbishment - 2002

*Type of building:*

**Hotel**

*Area:*

**6.000 m<sup>2</sup>**

*Before refurbishment:*

**486,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**301,80 kWh/m<sup>2</sup>yr**

*Energy savings:*

**38%**

*Investment:*

**150.000 €**

*Annual savings:*

**45.000 €/yr**



## Refurbishment

*Type of building:*

**Hotel**

*Area:*

**5.500 m<sup>2</sup>**

*Before refurbishment:*

**481,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**145,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**69%**

*Investment:*

**320.000 €**

*Annual savings:*

**27.000 €/yr**

## Hotel and rehab-clinic

*Sandwall 29, 25938, Wyk auf Föhr, Germany*

The Atlantis Hotel am Meer and Klinik Westfalen - Reha-Klinik am Meer is a combined hotel and hospital building with swimming pool and restaurant. The building was refurbished step by step and by using modern technologies and renewable energy the building owner has a share in climate protection.

The heating system was refurbished by installation of a centralized low temperature boiler for both buildings. The heating-pumps has been modernized (difference pressure controlled) and by reduction of the volume of the sea-water-storage tank for the wellness area energy for heating could be saved. They also saved energy by implementation of measures to save water consumption.

Refurbishment of the fluorescent tubes by T5-technology and electronic ballasts.

The refurbishment of the hotel building envelope will be finalized in winter 2006/2007, the most parts are already insulated. This measure achieves an additional comfort-impact.

With the installation of a cogeneration plant of 15 kW electrical and 30 kW thermal power 60% of the heat and 30% of the electricity demand are supplied in efficient cogeneration.







## Hotel Jakue

*Navarra, Spain*

The Jakue complex is a true “Green Building”, was the first environmentally smart tourist building, and the fourth building to be certified in the whole of Spain.

This is a European certificate awarded to buildings constructed with maximum respect for the environment and in which, in addition to good environmental practices, considerable investment has been made in order to achieve zero atmospheric emissions.

This hostel uses solely biomass and renewable energies.



**n/a**

*Type of building:*

**Hotel**

*Area:*

**n/a**

*Before refurbishment:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

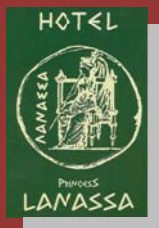
**>25%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2006**

*Type of building:*

**Hotel**

*Area:*

**2.300 m<sup>2</sup>**

*Reference value:*

**137,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**82,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**40%**

*Investment:*

**16.000 €**

*Annual savings:*

**4.000 €/yr**

## Hotel Princess Lanassa

*Kostitsi —Ioannina – Epiros, Greece*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Lighting: Low consumption lighting fixtures — bulbs, motion sensors, timing switch.

Highly insulated low-e windows: Windows with thermal gap and low emissivity glazing.

Air conditioning controls: Automatic control for non-operation of air conditioning units when openings are not closed.

Centralised Heating plant: Centralised boiler room, to cover main hotel and satellite buildings, gymnasium & spa area.





## Hotel Wende

*Seestraße 40-42, A-7100 Neusiedl/See, Austria*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: New gas condensing boiler; New regulation thermostats; New circulation pumps.

Lighting: All lamps exchanged for ESL.

Ventilation: Ventilation of the indoor swimming pool with new heat exchange and heat pump.

Others: Refurbishment of indoor swimming pool (new pumps, water saving measures)



### Refurbishment - 2010

*Type of building:*

**Hotel**

*Area:*

**8.896 m<sup>2</sup>**

*Before refurbishment:*

**327,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**235,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**28,1%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2009

*Type of building:*

**Office**

*Area:*

**4.600 m<sup>2</sup>**

*Before refurbishment:*

**112,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**49,40 kWh/m<sup>2</sup>yr**

*Energy savings:*

**56%**

*Investment:*

**1.100.000 €**

*Annual savings:*

**25.000 €/yr**

## Hoval Bürogebäude

*Hovalstraße 11. A-4614, Marchtrenk, Austria*

The plan contains measures like the replacement of all windows, insulation of the external wall with facade panels and renovation of the roof. Moreover, about 200 m<sup>2</sup> of facade solar collectors will be mounted on the southwest side of the building.

The heating system has already been modernised in 2006. The conventional boiler with a forced draught burner, was replaced by a gas-fired condensing boiler. Due to the ideal modulation range and the increase of the efficiency factor the prime energy demand was reduced by about 10%. All of the circulating pumps were changed to types with high efficiency motors and their speed setpoint is controlled by the central building control system. As a result, the consumption of electricity could be reduced and the hot water volume was regulated.

For climate control Hoval installes three air recirculation units in the office building (one for two floors). This draws in room air which it cools indirectly adiabatically (i.e. high cooling effect but low expenditure of energy) by means of plate heat exchangers and then blows the cooled and filtered air back into the hall again. Fresh outside air is used for cooling the room air.

Special exterior blinds are used for protection from the sun. These blinds are automatically timed by the central building control system. The ideal position of the lamellas is controlled by sun sensors. Therefore the cooling demand in the office building is reduced considerably.





## Kv Packarhuset 4

*Norrmalmstorg/Stureplan, Stockholm, Sweden*

Some of the actions to reduce the use of energy:

New air conditioning systems with energy recovery.

Optimization of times of operation for the air conditioning system.

A new computerized system for monitoring was installed.



### Refurbishment - 2004

*Type of building:*

**Office**

*Area:*

**15.249 m<sup>2</sup>**

*Before refurbishment:*

**271,90 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**182,20 kWh/m<sup>2</sup>yr**

*Energy savings:*

**33%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment - 2006

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**18.491 kWh/yr**

*Primary energy demand:*

**10.951 kWh/yr**

*Energy savings:*

**41%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## HUK-Coburg

*Bahnhofsplatz, 96444 Coburg, Germany*

For the building of the HUK-COBURG at Coburg railway station square, energy savings are achieved mainly by implementing a variety of measures such as:

The existing air conditioning systems will be modernized, the heat load is reduced by cooling blankets and the air exchange rate can be reduced.

Installation of new ventilation systems with heat recovery technology to replace the outdated existing systems.

Furthermore, a combined heat-cold coupling in the data center is used.



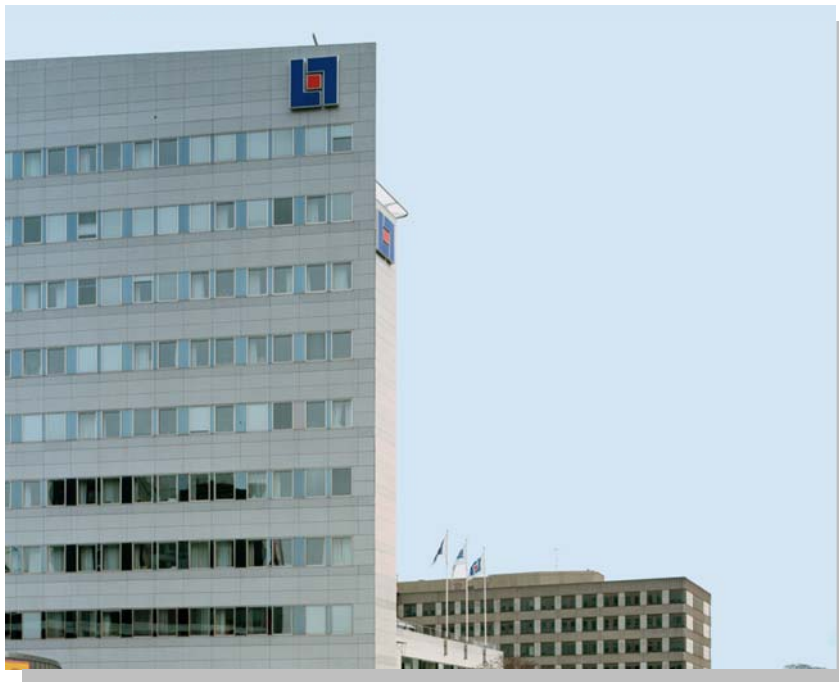


## Bremen 2

*Tegeluddsvägen 11-13, Stockholm, Sweden*

The energy management system is ISO 14001 certified. The company has its own staff to run and follow up the energy use in all buildings on a monthly basis.

The building have been constructed as a low energy building. The ventilation systems have been exchanged and the buildings have been trimmed to run only during office hours.



### Refurbishment

*Type of building:*

**Office**

*Area:*

**36.500 m<sup>2</sup>**

*Before refurbishment:*

**121,8 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**67 kWh/m<sup>2</sup>yr**

*Energy savings:*

**45%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2003

*Type of building:*

**Office**

*Area:*

**23.400 m<sup>2</sup>**

**24.300 m<sup>2</sup>**

*Before refurbishment:*

**152,00 kWh/m<sup>2</sup>yr**

**145,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**97,00 kWh/m<sup>2</sup>yr**

**105,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**36%**

**27,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

The energy management system is ISO 14001 certified. The company has its own staff to run and follow up the energy use in all buildings on a monthly basis.

The ventilation systems have been exchanged and the building has been trimmed to run only during office hours. District heating and cooling has been installed.

## Bremen 4

*Tegeluddsvägen 15-23, Stockholm, Sweden*



## Härden 16

*Norra Stationsgatan 61, Stockholm, Sweden*





## Astern 1

*Köpmannagatan 1, Söderhamn, Sweden*

Main measures: Change to new control system – 10 % heat saving; Set the indoor temperature to 20-21°C; Computerise the control system with surveillance.

HUSÖ Fastighets AB has an environmental policy where they state that they work on long-term basis to reduce the energy consumption. Examples of general measures considered and implemented: Heating of the buildings is done by district heating, in larger office buildings computerised control systems are installed, heat-recovery is used for ventilation and energy efficient lighting is used.



### Refurbishment - 2005

*Type of building:*

**Office**

*Area:*

**4.785 m<sup>2</sup>**

*Before refurbishment:*

**353,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**264,90 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2005

*Type of building:*

**Office**

*Area:*

**2.006 m<sup>2</sup>**

*Before refurbishment:*

**174,50 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**108,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**37,7%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Tingshusbacken 11:1

*Lagmansgatan 1, 82443, Hudiksvall, Sweden*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Change from oil to district heating.

Decreased U-value for the ceiling from 0,22 to 0,11. Energy loss decreased from 14 500 kWh per year to 7259 kWh per year, about 50 % reduction.

Installation of heat recovery with 80 % efficiency. Energy consumption decreased from 19 000 kWh/year to 6 000 kWh/year, 68 % energy saving.

Installation of computerised control system for heating and ventilation assumed energy saving is 3-7 % of the total energy consumption.





## Hauptschule Hüttenberg

*Knappenbergerstraße 5, 9375, Hüttenberg, Austria*

After the successful thermal building renovation, now heat load of the building on energy consumption and measurements are determined to ensure that the boiler is designed optimally.

The existing light heating oil plant (BJ: 1976) in an Energy Contracting vertrages is replaced by a pellet plant. Also was a renovation of the heating water. For the gymnasium wing (including the school kitchen) is now a central 800-liter water storage provided in the boiler room. In winter the water should be provided on the heating system, in the summer (practically no demand for hot water) is electric. Thus, especially in the school kitchen at any time hot water is available. In the sanitary units in the classrooms no hot water is provided.

In 2006 the entire electric installations have been renewed. In the course of which was also the replacement of all lighting fixtures. It was installed new lights with the corresponding reflectors (mirror louvre luminaires) and electronic ballasts.

Likewise, the new coat of paint in the classrooms of high degrees of reflection (white coat), and thus to an additional reduction of energy consumption taken into consideration.



### Refurbishment - 2006

*Type of building:*

**Educational**

*Area:*

**2.100 m<sup>2</sup>**

*Before refurbishment:*

**288,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**98,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**65,8%**

*Investment:*

**1.395.000 €**

*Annual savings:*

**12.000 €/yr**





**New - 2010**

*Type of building:*

**Office**

*Area:*

**13.127 m<sup>2</sup>**

*Reference value:*

**79,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**57,20 kWh/m<sup>2</sup>yr**

*Energy savings:*

**26,8%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Innovation & Technology Central Laboratory

*c/o Parco Scientifico Tecnologico Kilometro Rosso, Via Stezzano - 24100 - Bergamo (BG), Italy*

Designed by American architect Richard Meier, aims to meet even the most stringent requirements in terms of energy saving and design innovation quality.

Alternative energy sources and innovative, sustainable materials have been widely used. The installation of photovoltaic panels capable to generate over 54,560 kWh a year, for a total saving of 12.7 metric tons of fossil fuels, together with solar panels will allow cutting consumption of conventional energies and thus emissions of atmospheric CO<sub>2</sub>.

A further contribution to CO<sub>2</sub> emission reduction will come from the geothermal power plant that exploits the heat source stored in the soil and subsoil.

The excellent energy performance of this building will be in a position to cut its energy consumption levels by up to 60% compared to the statutory requirement currently, thanks to the methods and materials with which the building's envelope has been built and to the use of renewable energy sources. Another very interesting aspect is that i.lab is at the same time a low-energy and an artistic building featuring high-quality architectural elements.





## Centralstation

*Stockholm, Sweden*

Larger LCC systems for reusing left over heat from the central hall will be installed.

New pipes and ventilation system will be installed. Ventilation and heating will be used only when needed.

Installation of a heatpump: The cool side of the heatpump (200 kW) will be used for the Central Station, plants and areas within kv Blekholmen 4 that need cooling during the heating season. The warm side of the heatpump (300 kW) will deliver warm water to the heating system and to the hot water supply.

Ground heating will be connected to a central cooling spot that is heated with reused heat.

Free cooling from a nearby lake will be used.

The tunnel leading to the trains will be heated by "left over" air from the stores in the building.

LED lighting will be installed instead of traditional lighting bulbs, and lighting will be time managed.

All energy use will be followed up on a regular basis.



### Refurbishment - 2009

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**667,00 kWh/yr**

*Primary energy demand:*

**429,00 kWh/yr**

*Energy savings:*

**26%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2009**

*Type of building:*

**Office**

*Area:*

**39.000 m<sup>2</sup>**

*Reference value:*

**117,50 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**75,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**35%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Kungsbrohuset

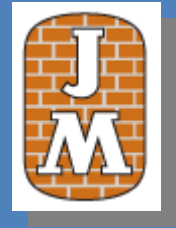
*Blekholmen 4, Stockholm, Sweden*

Heating will be supplied from the municipal district heating systems with a possible addition of a solar thermal collector system on the roof. Cooling will be provided through connections to the municipal district cooling system. In addition a system for free cooling via fresh water from Lake Mälaren is planned. This will operate from approx October to April. In addition, the potential for a rock-storage for heating and cooling will be investigated.

Plant for air-handling will be placed on floor 2 comprising two separate units, each with filters, cooling-recovery, heat-recovery, heating coils, cooling coils and fans. Treated air will be supplied to the offices via active cooling beams and air-extract will placed centrally and in pantries and restrooms.

The following measures are being planned: Low U-values on window glazing. High performance sun shading. Air tight shell on building, 0,30 l/sm<sup>2</sup>. Airhandling systems, SFP-rate 1,5kW/(m<sup>3</sup>/s). Heat-recovery-efficiency in air handling units 75%. Cooling recovery in air handling units. Pre cooling from cooling beams in offices. Free-cooling from Lake Mälaren for parts of the year.





## Frösunda Park

*Solna, Sweden*

The building is supplied with heating and cooling. Hot water heat exchanged district in the center. The thermal heating (radiators, convection) is divided in 3 systems. Two front-oriented systems for offices and a system for premises with widely varying loads as conference rooms, etc. Heating system has separate heat exchange against the district. Heat treatment for air heat-exchanged separately against district.

Cooling is distributed both to the air handling units and rooms with special requirements and the chilled beams of office space. Cooling for air treatment is a condensing system while cooling for chilled beams is a dry system with outdoor-climate compensated supply temperature. Office supplied mainly through an air handling unit with rotating heat exchangers and combined battery of cold and heat. Supply to the garage space is taken from the waste air from the office. For restaurant and kitchen is a separate and extract air units with battery heat exchange. Heat is also out of evacuated from the garage and into the supply of kitchen and restaurant.

To get the mist from the kitchen we have separate air blower. This fan is not equipped with heat.

JM operates a service technology group that has monthly meetings concerning, among other energy issues. They together have the responsibility for statistics and monitoring of energy targets.



**New - 2009**

*Type of building:*

**Office**

*Area:*

**11.650 m<sup>2</sup>**

*Reference value:*

**113,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**85,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment

*Type of building:*

**Institutional**

*Area:*

**53.445 m<sup>2</sup>**

*Before refurbishment:*

**320,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**189,50 kWh/m<sup>2</sup>yr**

*Energy savings:*

**40,9%**

*Investment:*

**1.960.000 €**

*Annual savings:*

**449.084 €/yr**

## Penitentiary Moabit

*Alt Moabit 12, 10559 Berlin, Germany*

Within the following areas measures to improve the energy performance has been implemented:

Refurbishment of the heating system (new efficient electronic pumps, string control valves and other fittings, partially refurbishment of selected heater loops); Hydraulic balance of the heating system; integration and adjustment of thermostatic valves on radiators; Regulation of the warm water production.

Energy source conversion for steam generation: Closure and dismantling of oil fired steam boiler; closure of oil tanks; Installation of gas fired local steam boilers.

Ventilation: Optimisation of the regulation of the ventilation system.

Substitution of incandescent lamps through compact fluorescent lamps; Re-lamping of fluorescent lamps through efficient T5 lamps including electronic v ballasts; Refurbishment of all PC work place lighting.

Central building control system: Integration of a comprehensive energy controlling system; Installation of several measurement instruments for electricity, heat and water.

Installation of an aquatic well supply incl. water treatment; Installation of water saving aerators for showers and wash basins; Reduction of flow rate in WCs and urinals.







## Penitentiary

*Paradeplatz 5, 34613 Schwalmstadt, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Dismantling of two natural gas boilers and one natural gas heat pump Installation of a new 1200KW natural gas fired low temperature boiler; Installation of a new natural 700kw gas fired condensing boiler; Modernization of the heating distribution system (new pumps with differential pressure regulation, new valves and new fittings); Hydraulic adjustment of the heating system; Optimization of the outgoing temperature ( rebuilding of the sink, closing of the 90/70 piping system). Installation of a natural gas block heat and power plant with 238 kWel and 363 kWth.

Installation of frequency controller of the ventilators Demand-orientation of the air supply and outlet air; Installation of additional sensitive elements; Optimization of zone regulation; Reduction of the flow rate.

Installation of consumption meters (in all buildings): Complete renewal of RLT-control by new control boxes, performance parts and new DCCs; Expansion of central building control systems, circuit-entering of all relevant data points.

Continuous energy consumption recording; Consumption control, analysis and processing of data, determination of tendencies; Energy report with information to the development of energy consumption and savings.



### Refurbishment - 2007

*Type of building:*

**Institutional**

*Area:*

**27.468 m<sup>2</sup>**

*Before refurbishment:*

**71,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**27,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**61%**

*Investment:*

**883.166 €**

*Annual savings:*

**148.455 €/yr**



## Refurbishment - 2007

*Type of building:*

**Commercial**

*Area:*

**38.200 m<sup>2</sup>**

*Before refurbishment:*

**123,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**92,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25,1%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Bäckebol Homecenter- Huvudbyggnaden

*Paradeplatz 5, 34613 Schwalmstadt, Sweden*

The building's heating takes place mainly through the preheated supply air.

In summer the inside temperature is kept at a comfortable level using cooled supply air.

Since 2006, an intense energy optimization work has been done which resulted in the building's total energy use declined from 123 kWh / m<sup>2</sup>,year to only 92 kWh / m<sup>2</sup>,year (down 25.1%). Today's energy use is equivalent to only 63% of BBR (Swedish building regulations) requirements.

In addition to the measures already implemented are a number planned measures to further reduce energy use.

For example: installation of heat pump for heat recovery of waste heat from Coop Forum's food cooling and switching to energy efficient light bulbs in the mall.





## Main Office of the Federal Promotional Bank

*Palmengartenstraße 5-9, 60325, Frankfurt am Main,  
Germany*

The building - a sky scraper - has four different towers with different heights.

A central energy efficient exhaust-air ventilation system was installed that even provides in combination with other energy efficient features a sufficient cooling during the summer time.

Building envelope: 35% concrete core cooling of the ceiling, external sun protection, insulation panel with insulation thickness of 14 cm.

Combined heat and power plant that will support the cooling of the building. Server rooms are lying on the outside of the building so an efficient external cooling can be realized.

Existing co-generation (with absorption refrigeration machine) will also be used after refurbishment due to its already high energy efficiency, active cooling via cooling ceiling of at least 35% of the ceiling surface; adiabatic supply air cooling.

Use of energy efficient lamps.



### Refurbishment - 2006

*Type of building:*

**Office**

*Area:*

**26.000 m<sup>2</sup>**

*Before refurbishment:*

**245,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**130,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**46%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2009**

*Type of building:*

**Commercial**

*Area:*

**553 m<sup>2</sup>**

*Reference value:*

**265,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**127,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**52,2%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Gnoien

*Am Ziers 1, 17179 Gnoien, Germany*

KiK Textilien and Non-Food GmbH is a german textile-discounter with head office in Bönen. It was founded 1994. The company is the greatest textile-discount-chain in Germany and has over 2700 branches in Germany, Austria, Slovenia, Czech Republic, Hungary and Slovakia.

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating-system: combination of a heat pump and condensing boiler. Ventilation: central ventilation with heat recovery (WRG 80%). Use of air conditioning applying the principle of evaporative chill, regulated by fresh air.

Building envelope: insulation of the building envelope with low transmission losses (44% less than EnEV).





## Neuried

*Schafbacher Weg, 77743, Neuried, Germany*



## Mainhardt

*Im Seetal 13, 74535, Mainhardt, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

The use of an efficient ventilation, heating and cooling system in conjunction with an optimized shell we are sure to have the correct ratio between costs and efficiency.

Main measures: permanent shading devices; optimized shell; heating: activation of night-cooling; clear double glazed unit (6mm float + 12mm air + 6mm float); cooling system based on water distribution Control on the returns at 7/12.



**New - 2010**

*Type of building:*

**Commercial**

*Area:*

**753 m<sup>2</sup>**

**535 m<sup>2</sup>**

*Reference value:*

**360,60 kWh/m<sup>2</sup>yr**

**264,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**176,70 kWh/m<sup>2</sup>yr**

**117,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**51%**

**55,5%**

*Investment:*

**n/a**

**40.000 €**

*Annual savings:*

**n/a**





**New - 2010**

*Type of building:*

**Commercial**

*Area:*

**835 m<sup>2</sup>**

**636 m<sup>2</sup>**

*Reference value:*

**247,80 kWh/m<sup>2</sup>yr**

**267,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**106,20 kWh/m<sup>2</sup>yr**

**119,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**57,1%**

**55,2%**

*Investment:*

**75.000 €**

**40.000 €**

*Annual savings:*

**n/a**

## Rennerod

*Konnwiese 1, 56477, Rennerod, Germany*

## Moordorf

*Marktstraße 16, 26624, Sübbrookmerland, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Building envelope: Reducing unwanted solar heat gains by installation of permanent shading devices; Installation of a type of glazing Clear double glazed unit (6mm float + 12mm air + 6mm float); Installation of a type of frame Plastic. Improving insulation of opaque external walls, opaque external roofs, ground floor, vertical windows and transparent façades.

Heating system: Optimisation of the regulation, Activation of night-cooling. Cooling system based on water distribution, Control on the returns at 7/12.





## Klinikum Freising BA3

*Alois-Steinecker-Straße 18, 85354, Freising, Germany*

### Canteen kitchen & office building

*Alois-Steinecker-Straße 18, 85354, Freising, Germany*

The new construction will host the administration as well as the canteen kitchen of the clinical centre Freising.

As future operating costs and energy efficiency are concerns of particular importance to the owner, an energy consultant was assigned to monitor and supervise the design and overall construction phase of the building as well as to optimize future energy performance.

An optimized building envelope helps the building outperform governmental codes and mandatory thresholds in terms of energy consumption. Within the process of determining the actual technical concept, keeping piping as short as possible was considered in equal measure as implementing a system that enables to monitor and control later operations. Building users are moreover briefed in energy conservation measures linked to the building operation. In terms of primary energy source, the clinical centre intentionally decided to connect the municipality district heating system, which is powered via 90% combined heat & power share.



**New - 2010**

*Type of building:*

**Industrial**

*Area:*

**1.364 m<sup>2</sup>**

**1.820 m<sup>2</sup>**

*Reference value:*

**192,00 kWh/m<sup>2</sup>yr**

**987,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**108,00 kWh/m<sup>2</sup>yr**

**661,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**43,6%**

**33,1%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**2.000 m<sup>2</sup>**

*Reference value:*

**392,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**240,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**37%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Neubau Bürogeb

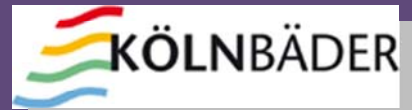
*Grabenstraße 27, 20357, Hamburg, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

The ventilation of the rooms is via window ventilation. Controlled air extraction is done in the toilet cores. Only in a conference room with a floor area of 25m<sup>2</sup>, there is the possibility of a cooled ventilation. A server room cooling is also taken into account with the balance sheet.

Thermal insulation of 14cm (035) in the facade, 20cm (035) on the roof, and 1.1 for the glazing for a good heat insulation, which also constitutes a good standard of housing.

The building is heated by district heating from cogeneration. For the summer heat with awnings wind sensors are installed.



## Ossendorfbad

*Alte Kanalstraße/Am Pistorhof, 50827 Köln, Germany*

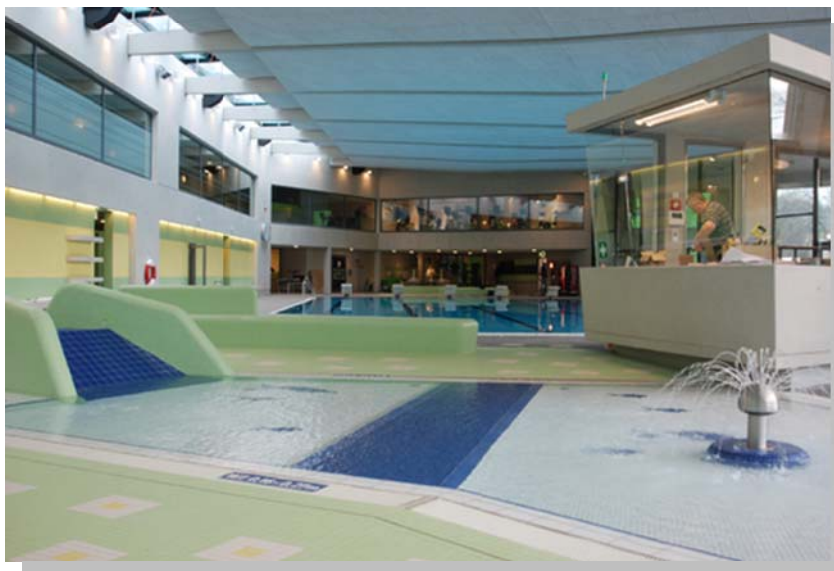
For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: combined heat and power unit, ventilation system with heat recovery >80%.

Lighting: energy-saving light bulbs and fluorescent tubes solar gains with roof-lights (glass sheets).

Building envelope: super-insulation panels were applied: envelope: 16 cm (type 035); roof: 25 cm (type 035); floor: 10 cm (type 040); windows:  $U = 1,1 \text{ W/m}^2\text{°C}$ .

Other measures: energy efficient heating pumps, day light control, insulation of the slide that protrudes of the building, hydraulic optimized pool technique.



**New - 2009**

*Type of building:*

**Leisure**

*Area:*

**6.769 m<sup>2</sup>**

*Reference value:*

**429,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**251,30 kWh/m<sup>2</sup>yr**

*Energy savings:*

**42%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2009**

*Type of building:*

**Commercial**

*Area:*

**5.400 m<sup>2</sup>**

*Reference value:*

**136,40 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**49,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**64%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Vecnamenski objekt A in B

*Maribor, Slovenia*

The complete building is ventilated, heated and cooled. The core of the planning process was a high energy efficiency of the entire system; and individual sets and appliances.

The energetic concept of this low energy facility includes the implementation of the following systems and devices:

Ventilation and air conditioning systems using indirect adiabatic evaporative cooling and high efficient heat recovery/regeneration; The use of a reversible heat pump in the ventilation device for the ventilation of the Mercator Center; The use a heat pump with the possibility of simultaneous cooling and heating medium production. The use of condensation heat from refrigeration systems of the Mercator ventilation system and other technology cooling systems; Optimal execution of building physics.

Optimization of the operating times of cooling and ventilation systems; Implementation of a digital control and regulation system and a remote system through WEB server to control all energy and ventilation equipment; Integral digital solutions regulation - individual fixtures and appliances interconnected.

Primary energy source geothermal energy – use of 100% renewable energy.







## Haus der Begegnung

*Bischof-Kaller-Straße 3, 61462 Königstein im Taunus,  
Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: insulated condensing boiler run with vegetable oil 2 x 200 kW; system temperature 55/45C.

Ventilation: central ventilation system with heat recovery  $\geq 80\%$ .

Lighting: fluorescent T5 lighting systems with ballasts.

Building envelope: for guesthouse: 15 cm mineral wool,  $U = 0,19 \text{ W/m}^2\text{K}$ ; façade (landmarked): 8 cm minerals wool; interior insulation on existing insulation,  $U = 0,3 \text{ W/m}^2\text{K}$ ; Windows: double-pane-insulation windows,  $U = 1,3 \text{ W/m}^2\text{K}$ ; Roof: 20 cm cellulose insulation,  $U = 0,21 \text{ W/m}^2\text{K}$ ; Basement: 2,5 + 4 cm polyurethane and polystyrene insulation  $U = 0,44 \text{ W/m}^2\text{K}$ .



### Refurbishment - 2010

*Type of building:*

**Institutional**

*Area:*

**3.515 m<sup>2</sup>**

*Before refurbishment:*

**617,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**116,90 kWh/m<sup>2</sup>yr**

*Energy savings:*

**82,6%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2011**

*Type of building:*

**Office**

*Area:*

**33.500 m<sup>2</sup>**

*Reference value:*

**95,10 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**69,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**27,4%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## KPMG Flintholm

*Dirch Passers Ale 2000 Frederiksberg, Denmark*

The window areas are optimised to give the best daylight conditions with the lowest heating demand and are alternated according to the orientation of the facade. Ones mounted in facades with high solar heat gains have automatic external shading devices. All windows and skylights are optimized in relation to the window's total thermal transmission losses (u-value), and the solar energy transmission (g-value). The building is constructed with concrete floors and cores, which gives the building a thermal mass to store heat and cooling. The lighting of the rooms is automatically controlled via daylight sensors. The lighting controller is divided into zones and are controlled with motions sensors.

All ventilation supply units are sized for low energy consumption, the SFP value (specific fan power) is approximately 1.9 kJ/m<sup>3</sup>. All units are supplied with high efficiency, rotary heat exchangers and chamber fans. All units have a night cooling function to cool down the building during the night. The main heating system supplied to the building is by district heating. This is then divided into two distribution systems, the radiator heating system and ventilation unit heating system. The radiator heating system is regulated by the outdoor temperature. The heating system is controlled by a building management system where the night cooling function, temperature curves, etc. are stored and used to optimize the system.





Kreis Offenbach

## Schul-und Bildungszentrum

*Alicestraße 107, 63263 Dietzenbach, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: gas central heating, low-temperature boilers with high efficiency 90/105 % heating surface with thermostatic valves in all rooms.

Ventilation: natural ventilation of the lounge area, mechanical ventilation system for the toilet with heat recovery.

Building envelope: material and parts with low pollutant emission; Exterior Walls: 14 cm insulation, WLG 040 + composite thermal insulation; Roof: 20 cm insulation, WLG 040; Basement: 10cm insulation, WLG 040; Windows: standard glazing,  $U = 1,6 \text{ W/m}^2\text{K}$ .



**New - 2010**

*Type of building:*

**Educational**

*Area:*

**3.883 m<sup>2</sup>**

*Reference value:*

**326,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**243,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25,4%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2005

*Type of building:*

**Institutional**

*Area:*

**n/a**

*Before refurbishment:*

**14.208 kWh/yr**

*Primary energy demand:*

**9.718 kWh/yr**

*Energy savings:*

**31,6%**

*Investment:*

**1.118.574 €**

*Annual savings:*

**178.537 €/yr**

## Kriminalgericht

*Turmstraße 91, 10559 Berlin, Germany*

It is planned to implement the following measures to save energy:

Heating: Shutdown of the 2nd district heating supply line with constant temperature; Reduction of the connected power; Refurbishment of the heating distribution system (new pumps with pressure-difference-regulation, new valves and other fittings will be refurbished); Hydraulic balance of the heating system; Integration and adjustment of string-regulation-valves.

Ventilation: Demand-Regulation of the supply air and exhaust air; Integration of CO<sub>2</sub>-sensors; Refurbishment and regulation of the ventilation system; Reduction of the flow rate.

Lightning: Installation of reflectors; Regulation of the lightning devices; Installation of several motion detectors.

Central building control system: Installation of measuring instruments to get information about the consumption of each building; Installation of single-room-controlling system to have the possibility to control the temperature and demand-time for each room; Integration of a DDC-System;





## Neues Verwaltungszentrum

*Mießtalerstrasse 1, 9020, Klagenfurt, Austria*

A heat pump will help to cover the additional energy demand. The ground water fulfils two purposes: It can be used for cooling and for heating purposes. In summer the ground water helps to cool the building and in winter the ground water is used for the heat pump. The thermal energy that comes from the ground water is used to heat the building as well as preheat the outside air of the ventilation system. The laying of the heater coils of the ventilation system of the offices happens on a low temperature basis.

Electric devices with as little energy demand as possible were planned, such as flat screens for example. Furthermore energy saving lights with infrared presence detectors and daylight sensors are installed. Such a sensor is activated when daylight circumstances require artificial light. In the publicly accessible passage ways lighting follows the half switch principle, which means that during the core office hours lights are working on full power and in the remaining hours lights work on half illumination intensity. When needed (e.g. when cleaning personnel is working) the half intensity mode can be switched to full mode.

The sun protection measures not only make the room climate more comfortable, but also help to reduce the use of artificial light. The so called day light technique implies separate opening and closing of the slats of the blinds. The upper part (1/3) can stay open while the lower part (2/3) shades the working place.



**New - 2008**

*Type of building:*

**Institutional**

*Area:*

**25.350 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**110,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**>25%**

*Investment:*

**26.500.000 €**

*Annual savings:*

**n/a**





## Refurbishment - 2008

*Type of building:*

**Institutional**

*Area:*

**11.720 m<sup>2</sup>**

*Before refurbishment:*

**n/a**

*Primary energy demand:*

**105,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**>25%**

*Investment:*

**24.400.000 €**

*Annual savings:*

**n/a**

## Technikzentrum und Institut

*Flatschacherstrasse 70, 9020, Klagenfurt, Austria*

The technical and laboratory centre in Flatschacher Street will consist of a 7 storey building including 290 work places for technical departments and a 6 storey building with 118 work places dealing with laboratory and food safety issues.

Heating: Concrete Core Activation, heat pump and district heating, radiators with thermostatic valves.

Cooling: Concrete Core Activation and cold from a ground water fountain.

Lighting: Energy saving floor lamps with infrared presence detector and daylight detector.

Building envelope: External sunscreen, the horizontal and bevel roof areas are leafy.





## LVR-Förderschule Louis-Braille

*Meckerstraße 1, 52353 Düren, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: district heating from cogeneration plant (gas).

Ventilation: ventilation system with heat recovery.

Lighting: efficient lamps with electronic ballasts.

Building envelope: Façade: 14 cm mineral wool;  $U = 0,21 \text{ W/m}^2\text{K}$ ; Windows: double-pane windows;  $U = 0,70 - 1,9 \text{ W/m}^2\text{K}$ ; Roof: 20 cm mineral wool,  $U = 0,14 \text{ W/m}^2\text{K}$ ; Basement: 10 cm insulation,  $U = 0,28 \text{ W/m}^2\text{K}$ .



### Refurbishment - 2010

*Type of building:*

**Educational**

*Area:*

**1.391 m<sup>2</sup>**

*Before refurbishment:*

**362,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**77,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**79%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Educational**

*Area:*

**6.815 m<sup>2</sup>**

*Reference value:*

**152,50 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**87,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**42,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Erich-Kästner-Schule

*Hans-Bokler Strasse, 59302, Oelde, Germany*

The main aspects of the energy concept are the reduction of the energy demand, the environmentally friendly production of energy (biomass boiler) and the efficient energy use.

Building envelope: Improving insulation of opaque building envelope. Improving insulation of transparent components of building envelope. Localisation and elimination of thermal bridges. Heat mirror glazed unit (6mm float + 16mm argon + 6mm ,low-e glass). Installation of movable shading devices.

Heating system: Installation of a low temperature boiler or a condensing boiler. Installation of well dimensioned heating pumps with power regulation. Installation of thermostatic radiator valves.

Introduction of luminaires with light direction, reducing the number of luminaires needed. Introduction of occupancy linking controls.

Use of Energy-Star criteria.





## Regenbogenschule

*Bröderichweg 43, 48159, Münster, Germany*

The school needed additional space and an extension to the existing school building was realized.

The extension is a two-storey building as an L-structure in the conventional solid construction. The building was connected to the local district heating of LWL-school. The building is regulated and monitored from the existing central building of management technology.

With the compact design, appropriate choice of external components and building materials, the legal limit of consumption of EnEV will be reduced by 30%. In addition, the successful sealing of the building envelope (blower door test) was examined.

The main aspects of the energy concept are the reduction of the energy demand and the efficient energy use.



**New - 2010**

*Type of building:*

**Educational**

*Area:*

**2.580 m<sup>2</sup>**

*Reference value:*

**315,90 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**233,20 kWh/m<sup>2</sup>yr**

*Energy savings:*

**26,2%**

*Investment:*

**161.250 €**

*Annual savings:*

**1.285 €/yr**





## Refurbishment - 2008

*Type of building:*

**Health**

*Area:*

**n/a**

*Before refurbishment:*

**258 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**180 kWh/m<sup>2</sup>yr**

*Energy savings:*

**30%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Avesta Lasarett

*Falun, Sweden*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

New control system.

Demand controlled ventilation.

Modernisation of district heating supply.

Heat recovery for 30 % of the hospitals ventilation system, some new control systems among others.







## Hus 1

*Karlstad, Sweden*

## Hus 2

*Karlstad, Sweden*

The buildings and their systems are designed with a structure that is characterized of modularity and flexibility that facilitates adaptation to different solutions. Systems and components will be designed with regard for life cycle costs and energy effectiveness. Energy use is ensured through energy simulations during the design phase and function controls of more important machines as air handling units. Heating is produced in a nearby local energy centre which supplies the building with energy for heating.

Heating and cooling are provided through 80 drill holes and connected to a heat pump.



**New - 2010**

*Type of building:*

**Health**

*Area:*

**n/a**

*Reference value:*

**151,30 kWh/m<sup>2</sup>yr**

**178,40 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**68,40 kWh/m<sup>2</sup>yr**

**130,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**54,8%**

**26,8%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**8.294 m<sup>2</sup>**

*Before refurbishment:*

**122,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**81,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**34%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## HK Grodden, Hus B

*kv. Fristaden at St Göransgatan 160 in Stockholm, Sweden*

The old ventilation system was not equipped with heat recovery system; the air supply is cooled and heated with air handling units connected to the district heating and cooling network. The building is heated with radiators and some rooms are cooled with room units. The control devices are old and not updated with the new technologies. Energy consumption in both house A and B for year 2007 was 1098.

MWh for heating, 121,3 MWh for cooling and 744 MWh total electricity consumption. The heating and cooling energies before rebuilding are distributed between the houses with respect to ventilation and the thermal properties of the building components. During the rebuilding all HVAC components will be replaced and a new control system will be installed. The new air handling units will be equipped with heat recovery. South- and west-facing windows will be equipped with automatic external sunshading. Temperatures and ventilation will be controlled to minimize energy use.





### Ecoedifici

*Av. Roma, 254, 08560, Manlleu, Spain*

The system finally selected is a high efficiency natural gas boiler combined with an electric cooling plant, with heat and cold distribution by low temperature radiant floor. Additionally, the air preheating through the greenhouse façade on the south, the heat recovery system and the optimised air renovation using air quality sensors, contribute to reduce the thermal energy demand.

The greenhouse façade on the south acts as ventilated façade in summer, contributing to reduce the solar heat gains of the building. The summer heat gains on the west face are also controlled by a ventilated façade and by the solar shadings produced by balconies and by external vertical movable shading devices. On the east façade, a patio contributes to create cross-ventilation in the building. Finally, a high insulation level is achieved.

High efficiency lighting equipment with fluorescent lamps and electronic ballast have been installed with a localised lighting system in the offices and occupancy linking detectors in spaces of sporadic use. Low energy consuming lifts are also employed.

5 m<sup>2</sup> solar thermal collectors and 18 m<sup>2</sup> photovoltaic panels have been installed on the roof of the building. The solar thermal panels should permit to cover 60 % of the DHW demand. The PV panels are supported by 2 solar tracking metallic structures and are connected to the grid. They should produce about 5.652 kWh annually.



**New - 2006**

*Type of building:*

**Office**

*Area:*

**1.114 m<sup>2</sup>**

*Reference value:*

**330,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**229,20 kWh/m<sup>2</sup>yr**

*Energy savings:*

**30,7%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**16.971 m<sup>2</sup>**

*Reference value:*

**53,50 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**27,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**48,3%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Office Building VZ13

*Vordere Zollamtsstraße 13, 1030 Vienna, Austria*

The building envelope will be a double-shell facade with integrated sun protection and daylight regulation. One new storey has been added on the top of the building, in course of this extension the roof of the building has been renewed. Consequently of the measures to improve the building envelope the values for heating and cooling demand are 48 and 52 % under the values required by the building code in place. The heating energy for heating and sanitary hot water is provided by district heating. Pipes have been insulated. The cooling energy for room conditioning in the summer is provided through district cooling.

Cold is delivered to the rooms through cooling ceilings. District heating and cooling is purchased from the Viennese energy provider which means that it comes from CHP plants powered by waste and biomass for a high extend. Especially for cooling, where there is a high amount of waste heat from electricity production available, this results in a low primary energy factor. Daylight will be used to a high extend, artificial lighting will be provided by compact fluorescent bulbs with light regulating prisms.







## Koy Polaris Business Park Castor

*Leppävaara, Espoo, Finland*

To achieve energy savings following solutions will be realised: Designing an energy efficient building concept, including technical solutions in insulation, air tightness, air conditioning, heat recovery and lightning.

Building envelope strongly affect the energy demand, since it regulates heating and cooling loads and daylight availability. In the office building Castor the potential energy savings of the window's and air tightness have been found and realised. All windows have internal blinds for glare control.

By improving the heat recovery units, rather than using the heat recovery units used in standardized buildings, we enhance the yearly energy efficiency from 30 % to 65,2 %.

Lighting has a substantial impact on the energy consumption in a office building. With the help of modern technology, major energy savings can be achieved. By installing presence detectors in each luminaire we calculate to reduce the electricity demand with 25 %.

An operation manual with instructions to the parties involved on how to use the building in the best way.



### New - 2011

*Type of building:*

**Office**

*Area:*

**n/a**

*Reference value:*

**186,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**125,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**32,9%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





**New - 2009**

*Type of building:*

**Commercial**

*Area:*

**1.412 m<sup>2</sup>**

*Reference value:*

**169,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**75,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**55,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Lidl Zukunftsmarkt

*Lidl-Filiale Korntal-Münchingen - Stuttgarter Straße  
73, 70625 Korntal-Münchingen, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: use of exhaust air from the chillers combined with floor heating – supply temperature 35 °C; energy efficient air heat pump for covering the remaining 10% heating demand.

Building envelope: concrete sandwich elements with core insulation of 8 – 10 cm,  $U = 0,54 \text{ W/m}^2\text{K}$ ; Windows: double pane windows with  $U = 1,3 \text{ W/m}^2\text{K}$ ; Roof: insulated roof,  $U = 0,2 \text{ W/m}^2\text{K}$ .



## Indoor swimming hall Floridsdorf

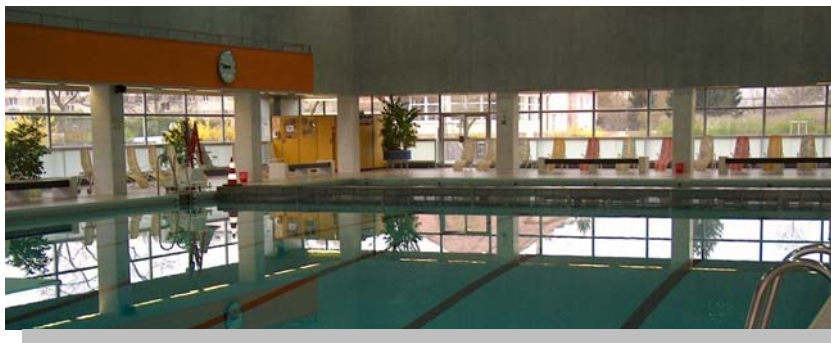
*Franklinstraße 2 , 1210, Vienna, Austria*

The heat energy-savings were reached by installing a solar power system including absorber mats by 1050m<sup>2</sup>. Depending on the time of the year the solar power system is warming up a 30m<sup>3</sup> water storage directly or indirectly by a heat pump. The heat of the outlet air of the swimming hall is also delivered to the heat pump. The heat gained by this heat pump is used for preliminary heating of supply air, underfloor heating and hot water. A heat recovery system was installed for the outlet air of the sauna.

The reconstruction of the ventilation system covered the exchange of the pneumatic regulation inclusive switching cabinets.

A control technology was installed for the whole building:

The filters of the bathwater were refurbished or exchanged and the flushing of the filters were optimised by means of new pumps. Measuring technique and chemical dosage were refurbished or renewed and the control system for the bathwater technology was exchanged as well in order to optimise the operation. The regulation installed was merged into the building control technology. The waste water of the filter flushing is collected in a storage tank and treated by means of membran filters. Additionally the showering armatures were retrofitted.



### Refurbishment - 2005

*Type of building:*

**Sport**

*Area:*

**18.400 m<sup>2</sup>**

*Before refurbishment:*

**347,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**125,20 kWh/m<sup>2</sup>yr**

*Energy savings:*

**64%**

*Investment:*

**3.128.491 €**

*Annual savings:*

**366.000 €/yr**



## Refurbishment - 2009

*Type of building:*

**Educational**

*Area:*

**3.128 m<sup>2</sup>**

*Before refurbishment:*

**238,90 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**62,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**74%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Volksschule Burgebrach

*Ampferbacher Str. 21, 96138 Burgebrach, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: geothermal heat pump (basic load) and pellet boiler; panel heating (system temperature 35/60).

Ventilation: central ventilation system with heat recovery  $\geq 80\%$ .

Lighting: fluorescent light bulbs with electronic ballasts.

Building envelope: 20 cm mineral insulation board,  $U = 0,18$  W/m<sup>2</sup>K; Windows: double-pane insulation windows,  $U = 1,0 - 1,3$  W/m<sup>2</sup>K; Roof: 20 cm mineral wool,  $U = 19$  W/m<sup>2</sup>K; Basement: 6 cm polyurethane insulation board,  $U = 0,34$  W/m<sup>2</sup>K.





## Primary School

*Clemens Holzmeister StraRe 34, 9131, Grafenstein,  
Austria*

The modernisation (renovation) of the primary school in Grafenstein aimed at revitalising the building envelope optically as well as preventing accidents due to the old heater system. Furthermore, the primary school, which was planned by the architect Clemens Holzmeister, was intended to become an energy efficient building, which was achieved by the insulation of the building envelope, the exchange of windows and the replacement of the old heater system.

Carried out measures: Insulation of the building envelope with EPS; Replacement of existing old windows; Exchange of old storage heaters against new energy saving storage heaters; Installation of a new heater regulation system including an automatic decrease control system (adjusted to the time table of the school).



### Refurbishment - 2006

*Type of building:*

**Educational**

*Area:*

**1.949 m<sup>2</sup>**

*Before refurbishment:*

**265,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**140,50 kWh/m<sup>2</sup>yr**

*Energy savings:*

**53%**

*Investment:*

**159.000 €**

*Annual savings:*

**11.633 €/yr**





## Refurbishment - 2006

*Type of building:*

**Office**

*Area:*

**11.500 m<sup>2</sup>**

*Before refurbishment:*

**118,90 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**14,50 kWh/m<sup>2</sup>yr**

*Energy savings:*

**88%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Werner-von-Siemens-Strß

*Werner-von-Siemens-Straße 41-43, 91054, Erlangen,  
Germany*

The refurbishment process started in August 2006. Special about the project is MAUSS BAU's strong emphasis on the overall view that leads to numerous synergy effects: besides an improved thermal insulation already existing heat storage capacity will be activated; solar radiation will be controlled by special shading systems combined with controlled use of artificial lighting. Another aspect is the very efficient use of primary energy by the application of a combined heat, power and cooling plant.

Heating: Installation of new combined heat and power unit, digitally regulated; single-room regulation, thermo-static valves.

Lighting: Complete substitution of lighting equipment with fluorescent lamps and electronic ballasts.

Building envelope: Improved insulation at roof and exterior walls, base-ment ceiling; improved windows.







## Maximilianplatz 12

*80333, München, Germany*

The façades and windows which are facing the square of the 'Opfer des Nationalsozialismus' and the main staircase are listed. An insulation of 10 cm was fixed on all refurbished facades – excluding the listed façade - to reduce transmission losses and thermal bridges. Windows were replaced to reduce transmission and ventilation losses due to better tightness.

Compared to a new building the heating demand is greater since parts of the buildings are listed and therefore not improvable. However, the primary energy demand is favourable as the thermal energy is provided through district heating with a high proportion of combined heat and power plants with a very low primary energy factor of 0,122.

Cooling happens by means of an underground channelled stream. An additional chiller ensures a temperature of at least 17 °C for the cooling ceilings in case the stream cannot provide adequate temperatures. The cooling energy of the water stream saves 40 % of final energy of electricity compared to a conventional chiller.



### Refurbishment - 2009

*Type of building:*

**Office**

*Area:*

**6.270 m<sup>2</sup>**

*Before refurbishment:*

**204,40 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**93,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**54,1%**

*Investment:*

**148.000 €**

*Annual savings:*

**n/a**



**New - 2009**

*Type of building:*

**Office**

*Area:*

**42.296 m<sup>2</sup>**

*Reference value:*

**183,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**104,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**43%**

*Investment:*

**148.000 €**

*Annual savings:*

**n/a**

## Cologne Oval Offices, no. 72 - 74

*Gustav-Heinemann-Ufer 72 -74, 50968, Cologne,  
Germany*

In the Cologne Oval Offices, living forms and facades, a highly practical interior and an elaborate ecological concept come together in an inspiring masterpiece. The envelope is insulated with highly insulating material. The folding shutters are the sunscreens. They are made out of colored glass and automatically controlled.

Heating: District heating, single room control.

Cooling device: Coolness is produced with ground-water.

Ventilation: Heat recovery (WRG 80%).





## Sonnencarree

*Sonnenstraße 19/ Josephstraße 15, 80331,  
Munich, Germany*

The refurbishment concept is based on the complete refurbishment of the facade and the renewal and extensions of the technical assets.

Heating: insulation of the plumbing; all offices are equipped with a motion/presence detector; if no one is in the office or if the window is opened, the room temperature will automatically be lowered.

Ventilation: efficient drive mechanism; heat recovery and interval timer; in the restaurant areas the ventilation can be adapted to the actual ventilation demand.

Air conditioning: chillers with the possibility of free cooling; all offices are equipped with a motion/presence detector; if no one is in the office or if the window is opened, the cooling valve will automatically be closed.

Lighting system: combined light and presence detectors for the offices; hallways, stairways and toilets equipped with presence detectors; energy efficient ballasts.

Building façade: insulation of the opaque façade; improvement of the energetic quality of the transparent façade; Roof insulation with mineral wool.



### Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**13.655 m<sup>2</sup>**

*Before refurbishment:*

**285,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**161,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**43,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**250.727 m<sup>2</sup>**

*Before refurbishment:*

**243,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**166,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**31,5 %**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Westgate Büro-und Geschäftsgebäude

*Habsburgerring 2-12, 50674 Köln, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: district heating and geothermal water heat pump (six wells); delivery volume 250 m<sup>3</sup>/h; thermal performance 872 kW).

Cooling: via heat exchanger of geothermal water heat pump (ground water used for cooling) cooling ceilings with condensation sensors.

Windows: venetian blinds controlled with light sensors.

Ventilation: mechanical ventilation system with heat recovery for heating and cooling and moisture exchange; ventilation via windows possible.

Building envelope: thermal according to building regulation.





## Maria-Josepha-Str. 13-15

*80802, Munchen, Germany*

The visual appearance from the outside is exposed concrete with an internal insulation. The thermal energy is provided through district heating with a high proportion of combined heat and power plants, hence a low primary energy factor of 0,36.

The cooling demand of the building is reduced to a minimum by natural night time cooling through a hybrid system which charges the thermal mass in the building. The remaining cooling demand is provided by a compression refrigeration plant.

The ventilation plant is supported by adiabatic cooling which pre-cools the fresh air and reduces the cooling energy demand by around 30%. Supply and exhaust ventilation systems include heat recovery systems.



**New - 2010**

*Type of building:*

**Office**

*Area:*

**9.512 m<sup>2</sup>**

*Reference value:*

**288,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**175,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**39,3%**

*Investment:*

**50.000 €**

*Annual savings:*

**n/a**





**New - 2004**

*Type of building:*

**Office**

*Area:*

**3.117 m<sup>2</sup>**

*Reference value:*

**115,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**72,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**62 %**

*Investment:*

**61.600 €**

*Annual savings:*

**8.920 €/yr**

## Menerga Maribor

*Zagrebška cesta 102, 2000, Maribor, Slovenia*

The basis of an energy saving building is a very efficient insulation. The building is in average insulated with a 16 centimeter layer of insulation and all thermal bridges are eliminated.

Comfortable working conditions for employees are also achieved with a permanent supply of fresh air into the rooms with three air-changes per hour. Ventilation with 100% of fresh outside air wouldn't be rational if it wasn't done with ventilation and air conditioning units that have heat recovery of 92% and humidity recovery of 87%. The basic heat source is underground water. In winter it has a temperature around 10-13°C, which assures that the heat pump works with a high coefficient of performance. The source of cooling energy is the heating pump which is a reversible heating – cooling unit. In summer it works in cooling mode. The thermally activated concrete construction acts as a large surface cooling unit.

Rooms are equipped with T5 fluorescent lamps, electronic controlled ballasts with a 0-10V analog input and light sensors. Efficient lighting of the work places follows the influence of the outside light and depending on the difference to the desired illumination continuously controls the intensity of the lamps.





## Merkur Klosterneuburg

*Aufeldgasse 45-49, 3400, Klosterneuburg, Austria*

Use of low energy refrigeration attributes: Generous evaporation area; Specially built air conduit; Use of energy saving circulation ventilation; consumption per ventilator: 7-9W; Use of electronic ex-valves in connection with specially constructed electronic control system; Electronic control of the glass heater.

Refrigeration systems, condensers and heating systems  
Attributes: Complete heat recovery from the refrigeration is used to heat the supermarket; Generous surface area of the condenser; Additional energy for heating under approx. 0 °C is supplied by a gas-fired condensing boiler; Therefore a buffer storage with a capacity of 2.000 l.; Only the difference of heating load is supplied by the boiler; Special electronic controls of the refrigeration plant reacting to the current surrounding temperature; Use of special electronic controls for the refrigeration and heating plants.

Use during operation with energy saving plants: Reduction in operation and connection costs; Consistent control of the cooling temperature; Extended working life of the compressor due to reduction in the frequency of switching; Reduction of the boiler power of approx. 45 %.

**New - 2008**

*Type of building:*

**Commercial**

*Area:*

**2.043 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**206 kWh/m<sup>2</sup>yr**

*Investment:*

**633.500 €**

*Annual savings:*

**n/a**



**New - 2009**

*Type of building:*

**Office**

*Area:*

**22.122 m<sup>2</sup>**

*Reference value:*

**48,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**21,80 kWh/m<sup>2</sup>yr**

*Energy savings:*

**54,5 %**

*Investment:*

**850.000 €**

*Annual savings:*

**n/a**

## Natura Towers

*R. Frederico George 1, Lisboa, Portugal*

Photovoltaic Panels located in the façades and in the rooftop, will produce the required energy to illuminate our common areas, landscape illumination and water fall alimentation; Solar Panels – Located in the rooftop, will entirely cover our needs in water heating, in bathrooms and pantries. From both rooftops, we will collect water from the rain, and store it in several water deposits in the basement, that provides the needs to water the plants located in the 3 squares of the complex, in the vertical walls of the buildings, and inside the double glass façade of both buildings.

The buildings will have a light saving system, EIB, that measures the amount of light in the working spaces from the exterior. In the basements, and in all our common areas, the lights are supported with movement sensors, in order to reduced energy.

The buildings will be constructed with a double glass curtain facade, with high sun control glasses, with a 65% energy absorption. This facade solution allows a night ventilation of the building, cooling it down in the Summer, and keeping it warm in the Winter, which will reduce our energy consumption in 69% in heating, and 41% in cooling. In the outside vertical walls of both buildings main areas, we will have approximately 1 000m<sup>2</sup> of plantations, and 80m<sup>2</sup> of a roof garden, that will produce oxygen and will reduce the Co2 emissions, and if possible, will help retain it; Inside the double glass curtain facade we will have plants that, besides giving an humanized and nature comfort, will provide a better air quality.





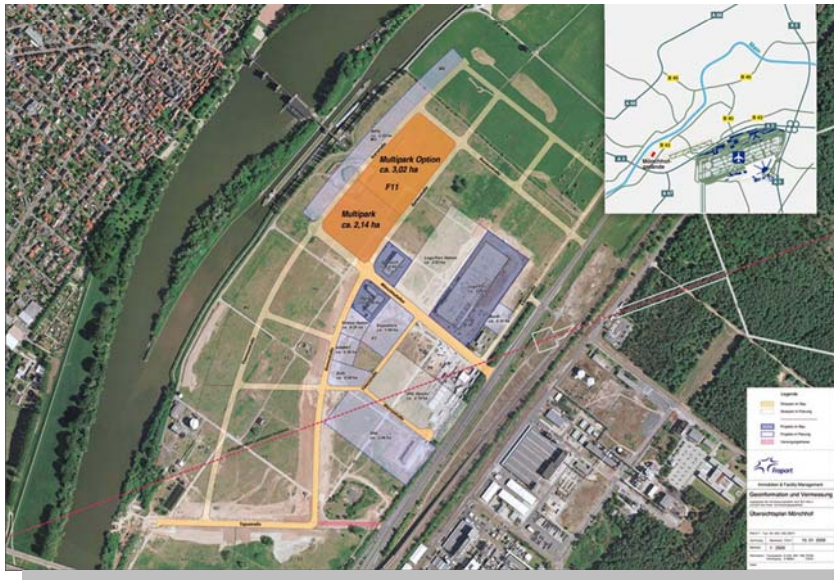
## Multipark Mönchhof II - Office

*Altrottstraße 31, 69190, Walldorf/Baden, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating & cooling: combination of ventilation system and air-water heat pump for heating and cooling.

Building envelope: insulation of 22 cm.



## Multipark Mönchhof II - Storage

*Altrottstraße 31, 69190, Walldorf/Baden, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating& cooling: Reduction of supply temperature through floor heating.

Building envelope: Reduction of thermal bridges, concrete walls in sandwich style, insulation of 4 cm



**New - 2009**

*Type of building:*

**Industrial**

*Area:*

**2.402 m<sup>2</sup>**

**3.275 m<sup>2</sup>**

*Reference value:*

**245,10 kWh/m<sup>2</sup>yr**

**278,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**170,20 kWh/m<sup>2</sup>yr**

**144,80 kWh/m<sup>2</sup>yr**

*Energy savings:*

**31 %**

**48%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Industrial**

*Area:*

**6.106 m<sup>2</sup>**

*Reference value:*

**144,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**123,80 kWh/m<sup>2</sup>yr**

*Energy savings:*

**38%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Handwerkerhof – Gebäude B

*Grundstück F11, 65451 Kelsterbach, Germany - 2010*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Building envelope: Insulation Wall = 0,240 W/(m<sup>2</sup>K) Exterior Walls (WDVS) = 0,236 W/(m<sup>2</sup>K) Facade: 0,256 W/(m<sup>2</sup>K) Basement: Instead of 6cm WLG040 Insulation lava rubble as Basement Insulation = 0,16 W/(m<sup>2</sup>K).

Management: Facility management is advised to keep the building operating according to the new-building standards.







## Zentrum für ganzheitliche Medizin

*An der Brunnenstube 17, 55120 Mainz-Mombach,  
Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: Solar assisted wood pellet heating system

Lighting: Natural lighting.

Ventilation: Decentral ventilation combined with heat recovery system.

Building Envelope: Ecological timber construction for preservation of resources, high insulation standard for energy saving and CO<sup>2</sup> savings, rainwater usage for toilet, systems with environmentally friendly characters.



**New - 2010**

*Type of building:*

**Health**

*Area:*

**773 m<sup>2</sup>**

*Reference value:*

**123,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**67,30 kWh/m<sup>2</sup>yr**

*Energy savings:*

**54%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment

*Type of building:*

**Office**

*Area:*

**n/a**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**>25%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Natuurpunt

*Belgium*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating pump (water) as main heating principle: this system in combination with a floor system can also be used for cooling in the summer.

No air-condition system: we choose for natural ventilation: we install 3 ventilation systems, 2 of which are winning back the heat (heat recuperation).

Solar collector for hot water: 4m<sup>2</sup> (no photovoltaic system)

By creating a atrium, we can use the energy-aspect of a double ventilated facade building (recuperation of solar heat, ...)

Ellipse-shaped wooden slats both fixed and revolving as sun-protection on the frontside of our building (south-orientated)

Insulation levels : we reach the level of a low energy building : K-value = 33: the glazing is double-glazed : U-value = 1,1.





## NCC GmbH Office Building

*Wolbecker Windmühle 55, 48167, Münster, Germany*

Before the new office building was built a energetic analysis according to the German Energy Ordinance (EnEV 2002) was made. The result was that increased energy saving measures were implemented.

For air conditioning a ground/water heat pump used for concrete core cooling was installed. Further cooling of the building is not necessary because the Green IT policies will significantly reduce the cooling demand - even for the server rooms.

The buidling is totally equipped with energy saving bulbs and electronic ballasts. Only in a few meetings room lumanaries were chosen because of opitcal reasons. Within the energy management these solution will be monitored

The plan ist to change the IT infrastructures according to Green IT Guidelines with short (2008) and medium term (until 2010) measures. With specific technical implementations and employee-awareness the annual energy demand of the office equipment will significantly be reduced.

The energy consumption ot the highly insulated building will strongly be influenced by the employees behavior. The staff's awareness will be be a part of a "design contest for energy savings in the workplace" in 2008.



**New - 2007**

*Type of building:*

**Office**

*Area:*

**1.207 m<sup>2</sup>**

*Reference value:*

**83,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**40,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**52%**

*Investment:*

**1.500.000 €**

*Annual savings:*

**n/a**



## **New Buildings**

*Type of building:*

**Office**

**Industrial  
Commercial**

### *Sweden*

NCC Property Development develops and sells commercial properties in growth markets in the Nordic and Baltic countries. 120 employees in Sweden, Denmark, Norway, Finland and Latvia. Became a GreenBuilding partner as early as 2006 in accordance with the European Commission's program for energy-efficient buildings. NCC Property Development have today six GreenBuilding project in Norden: Kolding Company House and Vallengsback Company House in Denmark, Kaggen, Västerport and COOP Kungsbacka in Sweden and Plaza III in Finland.

For each new office building, NCC will ensure that the building utilises at least 25% less energy than the national building code in use allows. The energy utilisation will vary between the different countries where NCC has buildings: Sweden, Norway, Finland, Denmark and Latvia.





## Kaggen

*Kv Bilen 4, Kaggen, Sweden*

The building will be connected to district heating and cooling. Heating and cooling are produced by heat pumps. Energy is accumulated in the ground, heat during the summer and cold during winter.

Electricity to the building will mainly come from wind power plants.

The U-value for the windows will be 1,3 with 0,25 in solar shading.

The ventilation has rotating heat recovery systems with 85 % efficiency.

Motion sensors control the lighting and all armatures are energy efficient.

An advanced control system for the installations will be installed.



**New - 2007**

*Type of building:*

**Office**

*Area:*

**9.000 m<sup>2</sup>**

*Reference value:*

**160,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**70,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**56,2%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





New

Type of building:

Office

Area:

15.403 m<sup>2</sup>

4.268 m<sup>2</sup>

Reference value:

202,00 kWh/m<sup>2</sup>yr

202,00 kWh/m<sup>2</sup>yr

Primary energy demand:

150,40 kWh/m<sup>2</sup>yr

131,50 kWh/m<sup>2</sup>yr

Energy savings:

25,5%

34,8%

Investment:

250.000 NOK

125.000 NOK

Annual savings:

960.000 NOK/yr

360.000 NOK/yr

## Lysaker Torg 45

*Bærum, Norway*

## Lysaker Nova

*Bærum, Norway*

Leading Nordic company within construction and property development. In property development we are focusing on offices, logistics and retail.

For this buildings, we have implemented the next measures:  
Presence sensors for lighting and Effective heat recovery.





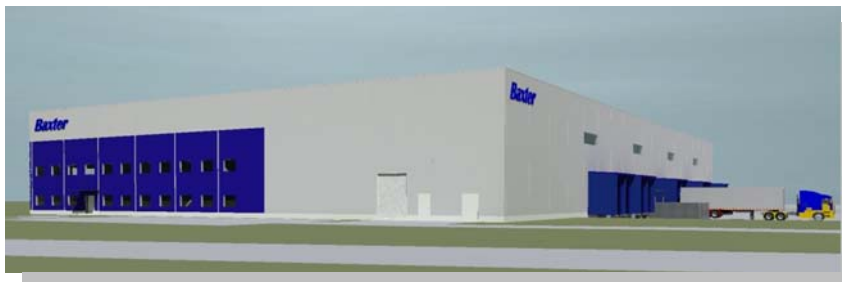
## Maskrosen

*Rosersberg, Stockhol, Sweden*

Leading Nordic company within construction and property development. In property development we are focusing on offices, logistics and retail.

In October 2010 Baxter Medical AB will establishing their Nordic warehouse and logistics center here.

Property is developed with high climate requirements. As the first logistics center Green-Building awarded in the Nordic countries, it is classified also under environmental BREEAM rating system, under-rated assessment, the building will achieve grade Very Good.



**New - 2010**

*Type of building:*

**Industrial**

*Area:*

**7.200 m<sup>2</sup>**

*Reference value:*

**100,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**69,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**31%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2008**

*Type of building:*

**Commercial**

*Area:*

**10.200 m<sup>2</sup>**

*Reference value:*

**102,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**73,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**29%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## COOP Kungsbacka

*Solna, Sweden*

Both heating and cooling will be supplied primarily by using a system for variable air volume (VAV).

Generalised system of ventilation in the room based on the return air mixed with air in order to meet hygiene requirements. The ventilation is need-controlled, driven from load in the room with respect to CO<sub>2</sub> levels and indoor temperature.



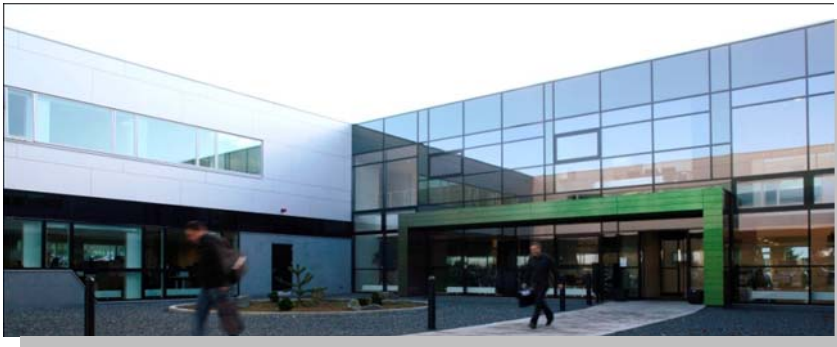


## Company House Kolding III

*Jupitervej 1, DK 6000, Kolding, Denmark*

Heating of the building is with radiators. Heating will only be needed on cold winter days outside the hours, when the building is not in use. When the building is in use, some cooling will nearly always be needed.

Two major ventilation systems will keep the building well-ventilated by means of outdoor air and airconditioned by means of outdoor air for cooling. On hot summer days the outdoor air will be 'cooled' (air-conditioned) by a cooling unit. The ventilation units supply the air in zones according to requirement. The units have heat recovery with high efficiency heating and cooling surfaces.



### New

*Type of building:*

### Office

*Area:*

**5.147 m<sup>2</sup>**

*Reference value:*

**100,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**68,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**32%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2009**

*Type of building:*

**Office**

*Area:*

**6.000 m<sup>2</sup>**

*Reference value:*

**95,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**70,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**27,7%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Company House Vallensbæk

*Delta Park 40. DK-2665 Vallensbæk Strand, Denmark*

The facades of the southern staircases will be equipped with integrated solar cells, and that the plant houses on the roof will be equipped with solar cell panels.

In addition day light control of the light installation is carried out and the building envelope will have windows and doors which reduce the heat loss through these with 50 per cent according to the demands of building regulations 08.







## Airport Plaza III

*Helsinki-Vantaa International Airport, Finland*

As building efficiency is improved with insulation and weather-stripping, buildings are intentionally made more air-tight, and consequentially less well ventilated. Since all buildings require a source of fresh air, the need for HRVs has become obvious. While opening a window does provide ventilation, the building's heat and humidity will then be lost in the winter and gained in the summer, both of which are undesirable for the indoor climate and for energy efficiency, since the building's HVAC systems must compensate. HRV technology offers an optimal solution: fresh air, better climate control and energy efficiency.

By improving the insulation of the windows we believe to reduce the U-Value from 1,40 W/m<sup>2</sup>K, which is the standard set by Finnish regulations, to 1,1 W/m<sup>2</sup>K. This results in a total reduction of approximately 20% in heat loss. By implementing ducts with a minimum size for the designated function all conference rooms, meeting rooms, etc will all be fixed. Therefore all ducts are being over dimensioned as well as the units. By over sizing the ducts and units the air pressure will be far lower, resulting in lower energy consumption of the fans. Air leakage is driven by differential pressures, across the building envelope. The mechanisms that create these differences in pressure are the combined effects of – stack (internal warm air rises), external wind (inducing +ve and –ve pressures on the envelope) and mechanical ventilation systems.

(BAS) core functionality keeps the building climate within a specified range, provides lighting based on occupancy, and monitors system performance and device failures and provides email and/or text notifications to building engineering staff.



**New - 2013**

*Type of building:*

**Office**

*Area:*

**6.876 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**38%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2005

*Type of building:*

**Hotel**

*Area:*

**10.353 m<sup>2</sup>**

**4.120 m<sup>2</sup> + 12.716 m<sup>2</sup>**

*Before refurbishment:*

**449,90 kWh/m<sup>2</sup>yr**

**434,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**320,20 kWh/m<sup>2</sup>yr**

**322,30 kWh/m<sup>2</sup>yr**

*Energy savings:*

**28,8%**

**25,9%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## NH Central Convenciones

*Avda. Diego Martínez Barrio, 8, 41013 Sevilla, Spain*

## NH Podium

*Bailén, 4-6, 08010 Barcelona, Spain*

For this buildings, energy savings are achieved mainly by implementing a variety of measures such as:

**Lightning:** Substitution of 100% lamps in common zones by low-consumption ones; Substitution of 100% of bedroom lamps by low-consumption ones; Occupancy linking detectors in spaces of sporadic use; Working hours control and limitation for the exterior lightning system.

**HVAC system:** Implementation of a centralized HVAC management system: substitution of the individual bedroom thermostats to get a more sustainable central management.  
**Hot Sanitary Water:** Implantation of a Domestic Hot Water recovery system.

The centralised automation control system has been modified to better adapt the thermal energy consumption of the building to the thermal load at each moment. NH Hotels has developed an energy management policy that achieve energy consumption reductions through some little control actions or projects which are mainly addressed to the hotel employees.





## NH Príncipe de la Paz

*Palacio real, Manuel Godoy, Aranjuez, Spain*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Technical measures: Replacement of 100% of low consumption lamps, motion detectors installation and programming time clocks in exterior and interior lighting; Implementation of a centralized technical management system, installation of solar film on windows of rooms; Installation variable speed kitchen exhaust hood and smoke detectors.

Management measures: Press fortnightly and monthly meetings, energy audits, design posters and sensitization module on-line training, motivation campaign for energy saving.



### Refurbishment - 2003

*Type of building:*

**Hotel**

*Area:*

**11.969 m<sup>2</sup>**

*Before refurbishment:*

**432,60 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**226,90 kWh/m<sup>2</sup>yr**

*Energy savings:*

**47,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**25.713 m<sup>2</sup>**

**14.118 m<sup>2</sup>**

*Reference value:*

**220,90 kWh/m<sup>2</sup>yr**

**214,10 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**121,90 kWh/m<sup>2</sup>yr**

**118,30 kWh/m<sup>2</sup>yr**

*Energy savings:*

**45%**

**45%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Olympia Office Tower

*Moosacher Straße 82, 80335, Munich, Germany*

## Olympia Office Tower (Campus)

*Moosacher Straße 82, 80335, Munich, Germany*

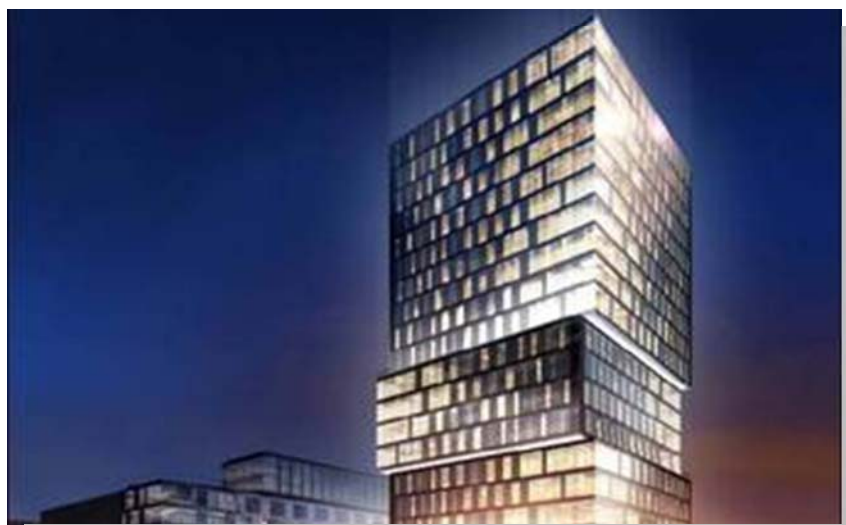
The building comprises two different building types - a high rise building and so called campus building. The campus building is L-shaped. The above-ground floors are mainly being used as offices.

The building is heated with district heating and with a ground water heat pump. The heat is transferred via an active building system and radiators. In summer the building cooled with concrete core temperature control. There is only an air-conditioning system for the server rooms.

Heating: Geothermal heat pump; District heating (heat and power cogeneration); Thermo Active Building Systems. Air condition: Natural cooling with ground water; Natural ventilation.

Lighting: Presence detector.

Compact double shell façade; Light metal frame construction; Windows: Double pane insulation windows.





## Public School

*Hine Møllevej 5900 Rudkøbing, Denmark*

To minimize the cooling demand, a design study was conducted on the orientation and distribution of the rooms. The daylight conditions have been an important parameter to reduce energy consumption when artificial lighting is used. It has been the goal to achieve good daylight distribution. Heavy constructions of concrete were chosen, where the high thermal mass contributes to regulating the thermal fluctuations of the building - especially in the summer. To minimize the heating demand, the buildings envelope and windows are highly insulated. To minimise the energy consumption of artificial lighting, a continuous day-light controller is installed in each room. In addition to the daylight controller, motion sensors are also installed.

The whole school is mechanically ventilated, which ensures the maintenance of a good thermal and atmospheric indoor climate for the staff and students. The ventilation system has a heat exchanger, which recovers approx. 85 % of the heat from the exhaust air.

100 m<sup>2</sup> of solar collectors are installed on the roof, which provides heat for the domestic hot water at the school. As well as providing heat for hot water production, the solar collectors also contribute to the under floor heating in the changing rooms. The anticipated contribution from solar energy is 3.3 kWh/m<sup>2</sup> year. The school is heated through a traditional radiator system.



**New - 2010**

*Type of building:*

**Educational**

*Area:*

**14.999 m<sup>2</sup>**

*Reference value:*

**95,10 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**70,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**26,3%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment

*Type of building:*

**Educational**

*Area:*

**2.029 m<sup>2</sup>**

*Before refurbishment:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**47%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Existing school building

*Duga Resa, Croatia*

The project includes streamlining the systems of heating, lighting and improving thermal insulation characteristics of the building with measures like:

Restoration of external joinery and building façades: On school are performed two types of construction works. The first type of works included the replacement of old windows with new windows with high energy efficiency. Another type of works included the improvement of thermal insulation of the façade. Replacing the external joinery was performed. Replacement of remaining old double wooden windows system and full wooden doors. New joinery from multiple use room with PVC profiles with two seals and glazed with thermo insulating glass LOW-e with a maximum heat coefficient  $U = 1.4 \text{ W/m}^2\text{K}$ . Thermal insulation of the facade was completed with the installation of additional thermal layer of polystyrene thickness 6 cm. Measures included rehabilitation of thermal bridges increasing the coefficient of heat passage from  $0.10 \text{ W/m}^2\text{K}$  to  $0.05 \text{ W/m}^2\text{K}$ .





## Biberstraße 5

1010, Vienna, Austria

The protected facade of the building can only be cleaned and coated, therefore, the refurbishment measures concern the interior design, the roof and the rear facade. On the rear facade, the roof and the fire-proof walls insulation will be added. The windows will be changed. Since it is also planned to achieve a building certificate according to klima:aktiv (Austrian certification system) building materials will be chosen with a focus on sustainability and chemical management will be implemented. The building will be heated with district heating (in Vienna mainly provided by CHP plants partly powered by waste and biomass). Sun protection will be added to the windows. Additionally cooling will be provided through cooling ceilings and will be produced by a 121 kW chiller. A mechanical ventilation system will improve the indoor air quality and comfort level. It will be equipped with a high efficient heat recovery. Additionally energy monitoring will allow the future users to check on their energy consumption regularly. This is the first time that the ÖGB takes care about energy efficiency in their building stock. Based on the experiences from this project the ÖGB will adapt the measures on their other buildings.



### Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**3.644 m<sup>2</sup>**

*Before refurbishment:*

**349,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**258,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**26,1%**

*Investment:*

**5.500.000 €**

*Annual savings:*

**10.560 €/yr**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**n/a**

*Reference value:*

**129 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**73 kWh/m<sup>2</sup>yr**

*Energy savings:*

**56%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Haga Vinge

*Sweden*

All work areas enjoy daylight, good lighting, an excellent indoor climate and a functional office layout. Energy consumption is combined with recovery, and everything that uses energy is customised to suit specific needs using selected technology:

Only 27 % of solar heat is allowed into the building.

Outdoor air is taken in for cooling providing it is colder than 15 degrees outside. When it is warmer than 15 degrees outside, district cooling is purchased from Norrenergi (cooling from Brunsviken).

Hot service water is heated by district heating from biogas.

When the supply air is lower than 15 degrees, the heat exchanger activates and starts heating using exhaust air. The district heating is then supported via traditional radiators.

Intelligent lighting control throughout. For each tenant there is a "green" button – the person who leaves the office last presses the button which then shuts down everything that is on stand-by (apart from computers). A separate power grid is used for computers and electrical appliances.





## Pfizer ABs office

*Silverdal, Sollentuna, Sweden*

City district heating, based on biomass and combined heat and power, is chosen for heating and domestic hot water instead installing a separate heating plant (boiler house).

City district cooling system, based on waste cooling from heat pumps and on free cooling by the Baltic Sea, is chosen instead of installing chillers. The city net is located a few thousand meters away but new distribution pipes are to be installed to connect the building.

The HVAC system on the office floors is based on water distributed cooling by chilled beams. The ventilation rate can this way be dimensioned for hygienic rather than comfort demand, in this case 1,5 l/s and sqm, which is twice the airflow according to the building codes. Air Handling Units are supplied with double battery coil heat recovery exchangers for high efficiency and airflow speed through AHU is chosen so low, 1,6 m/s, that power demand is less than 1,5 kW/m<sup>3</sup> and s. Sound attenuators are not needed in the ducting system between the AHUs and the office floors.

Lighting is of HF type and controlled by integrated IR sensors that will dim down to 20% when there is no occupancy. Windows has low heat loss using inertia gas in between sealed glass, 1,2 W/m<sup>2</sup>,°C. Domestic cold and hot water system is equipped with low flow taps.



**New - 2005**

*Type of building:*

**Office**

*Area:*

**18.613 m<sup>2</sup>**

*Reference value:*

**147,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**98,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**30%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2009

*Type of building:*

**Office**

*Area:*

**15.200 m<sup>2</sup>**

*Before refurbishment:*

**176,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**85,40 kWh/m<sup>2</sup>yr**

*Energy savings:*

**52%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## M202 Green Office

*Behringwerke, Werksteil Görzhausen, 35041, Marburg, Germany*

The office building has four stories. It is heated and cooled with geothermal energy. The facade is highly insulated. In summer the heat is stored via a ground source heat pump in the bedrock and is used for heating in winter. This works the other way round, too. In summer the building is cooled via the ground source heat pump with the lower temperatures of the bedrock. The building is heated and cooled with panel heating and cooling. That way no additional energy for a ventilation is needed.

Heating: geothermal heat pump, heat storage in summer via ground source heat pump in bedrock, panel heating.

Cooling: geothermal heat pump; via ground source heat pump in cooled bedrock; panel cooling.

Building envelope: highly insulated façade.

Windows: double pane insulation windows.





## Phoenix Plaza

*Sesvete/ Croatia*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Concrete 15 cm thick external envelope with 18 cm of thermal insulation achieves high level of heat retention.

Heating and cooling systems are suited to specific demand of different areas. For shopping area heat energy is produced by centralized air conditioning chambers with heat recovery using indirect adiabatic cooling and regeneration in summer period while additional heat energy is produced from external cooling devices. In retail area heat energy is produced from heat recovered from external air conditioning chambers while additional heat is produced by gas boiler.

Cooling energy is produced by external air conditioning chambers.

(In Croatia there are no legal values for primary energy and all calculations and comparisons were made based on heat energy demand.)



**New - 2010**

*Type of building:*

**Commercial**

*Area:*

**70.948 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**71%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2007

*Type of building:*

**Office**

*Area:*

**19.250 m<sup>2</sup>**

*Before refurbishment:*

**170,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**117,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**31%**

*Investment:*

**330.000 €**

*Annual savings:*

**55.000 €/yr**

## Central office building

*87 Syggrou Anenue, Athens, Greece*

Piraeus Bank is the fourth major Bank in Greece. It pays much attention in energy and environmental issues. It was also member of the Greenlight Program. Numerous measures in the field of ventilation, heating and cooling systems as well as its regulation and central control system were carried out.

Heat recovery from conditioned air stream mechanically exhausted from the building. Window shades: Installation of regulated venetian blinds in the internal space. Control of lighting conditions. Cooling Towers: Increase tower capacity from 170 to 220 RT Artificial lighting level control: Utilisation of natural lighting using dimmable ballasts. Sensors used to measure local lighting level. Building Management System: Installation of BEMS. Monitoring the indoor temperature, humidity etc, and controlling relevant subsystems (heating, cooling, lighting etc.). Ventilation: System for measuring the quality of air in the underground parking. It will control fans operation based on the level of pollutant gases (as CO). Power factor correction: Add capacitor systems at the main electricity board with storage capability 30% of the max demand.

Receiver of the EU Greenbuilding Refurbishment Award 2010





## Renaissance Malmö Hotel

*Rosen 8, Malmö, Sweden*

The property was built between 1880 and 1950 in different parts. The property is cultural heritage, meaning that façade and windows can not be exchanged. The refurbishment will include a new part of the building plus and expansion of the attic.

To reduce the building's energy consumption, the replacement of all the technical supply system was performed. New basic water systems that supply heat pumps for heating and cooling and hot water was installed. Energy used for heating and water will be reduced from 173 to 63 kWh/m<sup>2</sup> yr.

For monitoring and control energy consumption there is a continuous energy monitoring system which is directly connected to the overall management system. Planbo has its own organisation with service technicians that follow the statistics in each building on a monthly basis. The energy policy is confirmed by the CEO and specifies division of responsibility and administrative rules for dealing with energy related issues.



### Refurbishment - 2010

*Type of building:*

**Hotel**

*Area:*

**n/a**

*Before refurbishment:*

**208 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**117 kWh/m<sup>2</sup>yr**

*Energy savings:*

**44%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2004**

*Type of building:*

**Educational**

*Area:*

**8.765 m<sup>2</sup>**

*Reference value:*

**155,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**39,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**74%**

*Investment:*

**16,7 Mio €**

*Annual savings:*

**80.000 €/yr**

## Primary School and Day Care Centre

*Zur Kalbacher Höhe 15, 60439 Frankfurt am Main, Germany*

The following measures to improve the energy performance has been implemented:

Two automatically driven wood-pellet boilers 2x60 kW are producing the necessary heat.

Additionally to the wood-pellet boilers, the roof of the school is used by an independent operating company to run a 30kWPeak photovoltaic plant. The produced energy of 24 MWh/a is not contained in the calculation below.

The air conditioning system is a supply air system with heat recovery but without heat-registers.

To reduce the demand on electric lighting daylight switched jalousies (1/3, 2/3 canting) were installed. The classrooms were equipped with 6W/m<sup>2</sup> lighting density (300 lx) and the lighting consumption is reduced by using of central switch off after every lesson. The lighting of the halls is controlled by a motion and light detector. The electricity consumption is reduced to one third referring to average data.

The rear ventilated facade is implemented in a standard substructure with 25-28 cm of insulation. With additional detail solutions further heat losses could be reduced in the field of drainage, waste water etc.. The external walls are insulated with 24-28 cm insulation material. Automatically operating jalousies enable a maximal incidence of light. Therefore it is possible to largely abandon the use of artificial light.

The control system is connected over a LON-network to a OPCServer. The system permits an individual control of all rooms for heating, ventilation, lighting, sun protection and the smoke and heat vents.



## Arlanda DC 1

*Sigtuna kommun, Sweden*

The storage part of the building will be naturally ventilated via doors. The office is equipped with a FTX system. Heating is delivered by district heating. Ventilation and lighting will be controlled over time so that it is turned on only during office hours.

The Prologis energy policy includes: Implementing routines to fulfil law demand, Offering GreenBuilding certification in offer to customer, Overview of buildings energy demand every 5th yr or at change of tenant, Maintain buildings energy demand through continued education of properties operation manager, Installation of individual measurement in properties with more than one tenant, Annual follow up of measured data in order to reach a better energy demand in new building projects.



**New - 2010**

*Type of building:*

**Industrial**

*Area:*

**21.300 m<sup>2</sup>**

*Reference value:*

**100,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**57,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**43%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment - 2007

*Type of building:*

**Educational**

*Area:*

**2.748 m<sup>2</sup>**

*Before refurbishment:*

**101,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**49,90 kWh/m<sup>2</sup>yr**

*Energy savings:*

**50,7%**

*Investment:*

**309.000 €**

*Annual savings:*

**15.312 €/yr**

## I.T.I.S. "C. Zuccante" (administrative block)

*via Baglioni, 22, 30173, Mestre (VE), Italy*

The retrofitting of the administrative block can be considered as the pilot project of a program that aims to improve efficiency in energy uses and better internal comfort in all the buildings the Provincia di Venezia manages.

Thermal resistance of wall and roof will be raised by adding an external continuous insulating layer. Furthermore, old single pane metallic frame windows will be changed with new double LoE pane (filled with argon) windows with thermal break frame. By implementing all these measures a primary energy savings of 161 MWh/year will be expected.

Optimization of artificial lighting system using electronic ballasts.

Summer comfort will be improved by means of installing fans in the roof for ventilating rooms during the night and by painting the roof with light and IR-reflective coating.





## Humanomed Centre

*Moorweg 30, 9330, Althofen, Austria*

The environmental and energy saving project consists of two parts:

Change of the whole heat supply from gas to district heating from biomass. Reduction of the consumption because of solar engineering, heat recovery and process optimisation.

The Humanomed centre was connected to the district heating system of the Wärmebetriebe GmbH in the year 2008. The biomass comes from the Tilly Holzindustrie GmbH. Tilly utilised planning chipsand saw dust from the wood plate production and produces electricity and energy.

The Humanomed Centre will take energy (8 gwh/a). Because of the change of old gas boiler to district heating transfer stations a energy demand of 10-12 % can be realised.

The energy demand will be reduced about 15 % because of a lot of measures: optimisation of the cooling system because of a demand controlling system, heat recovery out of the bath water of the therapie basins, Installation of solar collectors for the heating of the mud bath and Optimisation of the damp production in the laundry



### Refurbishment - 2009

*Type of building:*

**Office**

*Area:*

**24.820 m<sup>2</sup>**

*Before refurbishment:*

**393,90 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**99,80 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25,2%**

*Investment:*

**362.400 €**

*Annual savings:*

**113.000 €/yr**



## Refurbishment - 2004

*Type of building:*

**Office**

*Area:*

**1.492 m<sup>2</sup>**

*Before refurbishment:*

**250,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**136,50 kWh/m<sup>2</sup>yr**

*Energy savings:*

**45%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## GeothermiePark Y

*Ytterbium 4, 91058, Erlangen/Eltersdor, Germany*

At GeoPark, a heating and cooling capacity of 60 kW is to be realised by using a reversible ground heatpump.

For this purpose, geothermal probes with a length of 1,2 km are being installed. By using the geothermal probes both for heating and cooling (often there is heating and cooling demand on the same day), the efficiency of the heat pump will be very high.

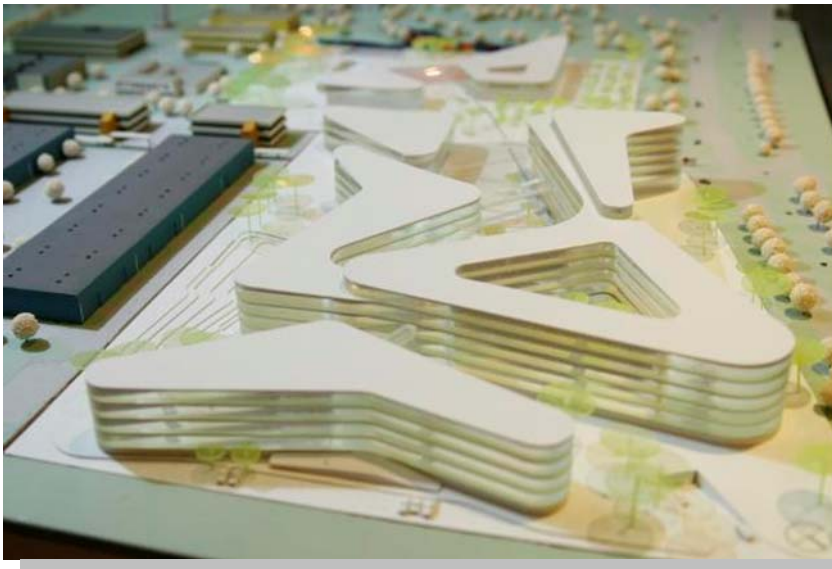




## Neubau Hauptverwaltung Gebäude 11

*Parkgürtel 24, 50823 Köln, Germany*

For this 5 buildings, energy savings are achieved mainly by implementing a variety of measures involving the building envelope, heating, lightning electricity and management, as we will see.



**New - 2010**

*Type of building:*

**Office**

*Area:*

**35.047 m<sup>2</sup>**

*Reference value:*

**197,60 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**99,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**49,8%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**8.583 m<sup>2</sup>**

**3.435 m<sup>2</sup>**

*Reference value:*

**137,40 kWh/m<sup>2</sup>yr**

**298,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**81,50 kWh/m<sup>2</sup>yr**

**97,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**40,6%**

**67,4%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Neubau Hauptverwaltung Gebäude 12

*Parkgürtel 24, 50823 Köln, Germany*

## Neubau Hauptverwaltung Gebäude 13

*Parkgürtel 24, 50823 Köln, Germany*

In the five buildings, measures implemented include:

**Building Envelope:** Improving insulation of envelope components and opaque building envelope/ external walls and insulation of vertical windows/ transparent facades by installation of movable shading devices.

**Heating System:** Installation of well dimensioned heating pumps with power regulation and activation of night-drawdown.







## Neubau Hauptverwaltung Gebäude 14

*Parkgürtel 24, 50823 Köln, Germany*

## Neubau Hauptverwaltung Gebäude 15

*Parkgürtel 24, 50823 Köln, Germany*

In the five buildings, measures implemented include:

Lighting: Introduction of occupancy linking controls and daylight responsive controls.

Electric: Multi-function devices replacing separate single-function devices.

Management: Monitoring energy consumption with a Building Energy Management System.



**New - 2010**

*Type of building:*

**Office**

*Area:*

**1.948 m<sup>2</sup>**

**3.480 m<sup>2</sup>**

*Reference value:*

**191,00 kWh/m<sup>2</sup>yr**

**380,10 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**106,60 kWh/m<sup>2</sup>yr**

**102,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**44,1%**

**73,1%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2006**

*Type of building:*

**Office**

*Area:*

**81.852 m<sup>2</sup>**

*Reference value:*

**398,60 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**126,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**68%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Rondo ONZ 1, Pl-00-124

*Warszawa, Poland*

The construction walls of the building are of steel reinforced concrete; the elevations are executed in glazed form. In places, where steel reinforced concrete external walls appear as an elevation in metal sheeting, covering is applied.

Heat source is provided by a heating centre composed of eight technological modules. Heating agent pipeline with high parameters and pipeline installations executed from black seamless pipes with thermal insulation. Heating is performed through heaters and through air-conditioning convectors and 4-pipe fancoil. Air heating is also applied in the building. Heat is conducted to heaters, with which are equipped: central ventilation units, air curtains and heating-ventilation apparatus. Mechanical ventilation installation is to ensure change of fresh air in rooms in the quantities required with regard to hygiene, while in rooms served by the air conditioning installation, the appropriate temperature is maintained together with humidity control in the summer and winter. In the case of cooling the air central conditioning system is assisted by a fancoil system. For reduction of heat requirement and reduction of building operating costs heat recovery and free cooling installations are applied.

Lighting installation due to application of DALI control system is fully controlled depending on requirements of the user.



# Schwab

Versand GmbH



## Logistikzentrum/myToys Langenselbold

*Bielefeld, Germany*



**New - 2010**

*Type of building:*

**Industrial**

*Area:*

**19.000 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**>25%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2010

*Type of building:*

**Educational**

*Area:*

**2.936 m<sup>2</sup>**

*Before refurbishment:*

**334,40 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**43,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**81%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Hauptschule "Abt Bernhard Hilz"

*Rohrberg 5, 94491 Hengersberg, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: natural gas condensing boiler 120 kW; panel floor radiators; system temperature 45/38.

Ventilation: three central ventilation systems with heat recovery  $\geq 94\%$ . Air conditioning: free cooling via ventilation system.

Lighting: fluorescent light bulb.

Building envelope: 30 cm cellulosic insulation,  $U = 0,11 \text{ W/m}^2\text{K}$ ; Windows: triple-pane-insulation windows;  $U = 0,8 \text{ W/m}^2\text{K}$ ; Roof: 40 cm mineral wool,  $U = 0,35 \text{ W/m}^2\text{K}$ ; Basement: 3 +4 cm mineral wool and expanded polystyrene,  $U = 0,09 \text{ W/m}^2\text{K}$ .





## SeaBridge Logistics

*Havenrandweg Zuid, Belgium*

In this industrial building an overall energy saving of 73% will be realised mainly via the following measures: good insulation of the building envelope: insulation value of K22 in stead of the legal maximum value of K55, i.e. 30% energy saving; 1 MW photovoltaic powerplant, i.e. 43% energy saving.

Beside these measures, heat/cold will be recovered out of extracted air via heat-exchangers and heat/cold is generated via an air-air heat pump.



**New - 2009**

*Type of building:*

**Industrial**

*Area:*

**20.000 m<sup>2</sup>**

*Reference value:*

**282,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**76,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**73%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





**New - 2007**

*Type of building:*

**Health**

*Area:*

**3.000 m<sup>2</sup>**

*Reference value:*

**339,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**278,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**29,3%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Centre d'Atenció Primària

*Roger de Flor, Barcelona, Spain*

The building has been conceived to be responsive to seasonal comfort requirements and at the same time to contribute to the reduction of energy costs. The main energy savings measures are listed below:

Passive elements such as a fixed shading device upon the central patio and vertical and horizontal solar protections on the SW facade will regulate the relationship between natural daylighting and solar protection.

The heat and cold distribution with water based low temperature radiant ceilings permits to reach high coefficients of performance of the compression chiller and the condensing gas boiler.

To adjust the humidity to comfort levels and to prevent condensation on the cooled ceilings, an innovative energy efficient liquid desiccant dehumidifier with lithium chloride solution is integrated in the ventilation system.

The building also integrates renewable energy sources with PV panels for electricity production and ST panels for heating and domestic hot water.

Finally the Building Management System and the planned monitoring will also contribute to reduce the energy demand of the building, controlling the bioclimatic passive elements as well as the conventional air conditioning and the lighting system.



### Halle 8+9

*Lutherstr. 51, 02826 Görlitz, Germany*

For this building, energy savings are achieved by implementing a variety of measures such as:

New daylight controlled lighting in Hall 8. Insulation facade, roof and new windows.



#### Refurbishment - 2008

*Type of building:*

**Industrial**

*Area:*

**5.844 m<sup>2</sup>**

*Before refurbishment:*

**1.231,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**861,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**29%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

# SIEMENS



### Refurbishment - 2007

*Type of building:*

**Industrial**

*Area:*

**15.200 m<sup>2</sup>**

*Before refurbishment:*

**1.742,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**898,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**48,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Transformer Production Site

*Hegelstraße 20, 73230 Kirchheim unter Teck, Germany*

For this building, energy savings are achieved by implementing a variety of measures such as:

Heating: new heating system, zoning.

Lighting: daylight controlled.

Ventilation: new AHU with heat recovery and zoning, optimized start stop program.

Building envelope: façade, gates, roof , rooflights.





## FFM CB Extension – logistics

Germany

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Increasing the insulation from 8 cm to 10 cm; blowerdoor test for control of air tightness.

Heating: panel heating, local heat.

Lighting: low radiation lights with low delivery rate.

Ventilation: energy efficient ventilation systems

## FFM CB Ext. – production

Germany

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Reduced window areas; increasing the insulation from 8 cm to 10 cm. Heating: panel heating, local heat.

Lighting: daylight control; optimized ceiling lights. ventilation: ventilation system with heat recovery 74%

**New - 2009**

*Type of building:*

**Industrial**

*Area:*

**2.539 m<sup>2</sup>**

**5.143 m<sup>2</sup>**

*Reference value:*

**323,70 kWh/m<sup>2</sup>yr**

**305,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**220,20 kWh/m<sup>2</sup>yr**

**194,50 kWh/m<sup>2</sup>yr**

*Energy savings:*

**32%**

**36,3%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

# SIEMENS



**New - 2008**

*Type of building:*

**Industrial**

*Area:*

**2.914 m<sup>2</sup>**

*Reference value:*

**719,10 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**511,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**28,9%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## P. Generation Schwerlasthalle

*Lutherstr. 51, 02826 Görlitz, Germany*

The industrial building is planned for the production of industrial turbines and is in Görlitz. The new hall is used to optimize the final assembly, including loading. The building is 26.80 m wide, 106 m long and 22,10 m high.

The outer wall is made of reinforced concrete with sandwich panels. For the natural lighting on the north, east, and west facades horizontal and vertical bands of windows are provided. In the southern gable wall is located an 8 x 8 m large roller door, in the northern gable wall is a 7 x 6m wide roller door, in the western wall a longitudinal sectional door is provided with an opening of 5.10 m x 6m.

The roof structure consists of welded insulation on trapezoidal sheet metal. For fire protection 5 skylights are 3 m x 2.50 m provided with integrated RWA's (2 m x 2 m).

The building is heated by the existing local district heating (low temperature, sliding flow temperature).

The architectural design includes a compact design, advanced windows shares and presents a good structural insulation: including an insulation plate on the shop floor and Art Foam glass plates with 4 cm thickness.

Other measure includes an exchange of used ceiling downlights with high-pressure lamps with optical equivalent downlights with integrated fluorescent lighting and reduced power connection with electronic ballasts.



### P. Generation Mittellasthalle 81

*Rheinstraße 100 45478, Mülheim an der Ruhr,  
Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: - ground water heat pump (> 50 %) and condensing boiler heat buffering for domestic hot water and air curtains.

Lighting: lamps with dimming function. Building envelope: Insulation of ground floor, better glazing.



**New - 2009**

*Type of building:*

**Industrial**

*Area:*

**12.129 m<sup>2</sup>**

*Reference value:*

**519,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**386,30 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25,6%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

# SIEMENS



**New - 2009**

*Type of building:*

**Industrial**

*Area:*

**8.060 m<sup>2</sup>**

*Reference value:*

**1.364,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**1.018,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25,4%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Power Generation Bld. 60

*Huttenstrasse 12, 10553, Berlin, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: district heating (cogeneration).

Lighting: daylight control. Ventilation: volume control, free cooling. Building envelope: improved air-tightness.





## Kindernest im Rötelpark

*Helene Richter Straße 3, 91052 Erlangen, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Window: Installation of triple glazed windows / units (6mm low-e glass + 16mm argon + 6mm float glass + 6mm low-e glass) and wooden frames.

Building Envelope: Improving insulation of opaque building envelope, introduction of occupancy linking controls.

## Kita Kinderlaube

*Marie Curie Straße 35, 91052 Erlangen, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: district heating (cogeneration heat and power).

Lighting; Building envelope: airtightness test (Blower Door).



**New - 2010**

*Type of building:*

**Educational**

*Area:*

**788 m<sup>2</sup>**

**1.111 m<sup>2</sup>**

*Reference value:*

**221,30 kWh/m<sup>2</sup>yr**

**93,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**106,10 kWh/m<sup>2</sup>yr**

**43,40 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25,6%**

**40,8%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New**

*Type of building:*

**Educational**

*Area:*

**1.412 m<sup>2</sup>**

**n/a**

*Reference value:*

**64,20 kWh/m<sup>2</sup>yr**

**n/a**

*Primary energy demand:*

**21,50 kWh/m<sup>2</sup>yr**

**n/a**

*Energy savings:*

**66,9%**

**>25%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Kita SieKids

*81541 München St. Ingbert-Straße 23/25, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

construction: Building envelope got an improved insulation; Heat bridges have been optimized; 3-pane glazings instead of 2-pane; Air-tightness test with BlowerDoor.

Building services: 5,3 kWpeak PV plant (not included in EnEV 2002/2004); Presence detectors for artificial lighting.



## Kita Karlsruhe

*G.-Braun-Str. 16, 76187 Karlsruhe, Germany*







## Amberg A & D Kantine

*Werner-von-Siemens-Straße 48-50, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Displacement ventilation in the kitchen, zoning areas, heat recovery; usage-dependent ventilation.

Lighting: motion control and daylight control in dining rooms and motion control in auxiliary rooms.

Building envelope: insulation façade, improved.

## Siemens Mitarbeiter Casino

*Mozartstraße 28, 91052, Erlange, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Building envelope: insulation façade, improved glazing.

Lighting: daylight dimming function.

Ventilation: frequency control of ventilation motors for kitchen and dinning room. Cooling: induced by changes mentioned above.



**New - 2009**

*Type of building:*

**Social**

*Area:*

**3.154 m<sup>2</sup>**

**3.616 m<sup>2</sup>**

*Reference value:*

**684,60 kWh/m<sup>2</sup>yr**

**643,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**371,80 kWh/m<sup>2</sup>yr**

**477,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**46%**

**25,8%**

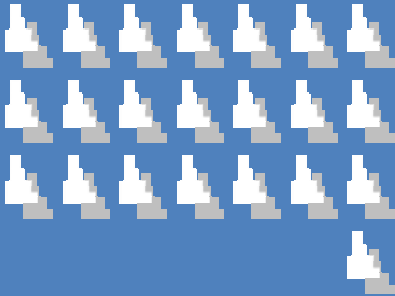
*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment

*Type of building:*

**Office**

*Area:*

**23.190 m<sup>2</sup>**

*Before refurbishment:*

**242,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**161,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**33,7%**

*Investment:*

**164.250 €**

*Annual savings:*

**99.400 €/a**

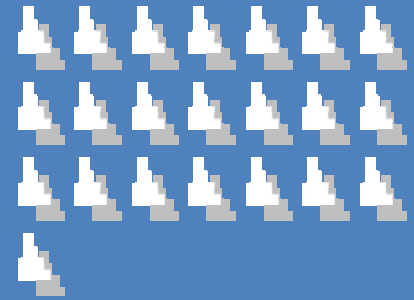
## München Perlach, Gebäude 9115

*Otto-Hahn-Ring 6, 81739 München, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Reduced HVAC run-time hours; Lowered HVAC air volume by 10%; Changed HVAC mixed air valves from manual operation to automated operation; Reduced heat energy consumption by installing an Optimum-Start- Stop-Program (OSTP) allowing night setback.





## 1749 Hofmannstraße 5

82379, Munich, Germany

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: thermal insulation for pipes, pumps with an optimised efficiency degree.

Lighting: optimisation of lighting (efficiency factor), installation of motion detectors.

Building envelope: thermal insulation for outside walls, windows with coated double glazing (low u-values) to reduce heat transmission.

## 1748, 1754, 1755 Hofmannstraße 51

82379, Munich, Germany

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: Exchange of heaters and heating sections, heating and warm water is provided by district heating.

Building envelope: Window:  $U_w = 1,6 \text{ W}/(\text{m}^2\text{K})$ ; wals:  $U = 0,34 \text{ W}/(\text{m}^2\text{K})$  New insulated envelope with insulating thickness  $d = 60 - 100 \text{ mm}$ , WLG 035

### Refurbishment - 2005

Type of building:

Office

Area:

4.876 m<sup>2</sup>

2 x 4.855 m<sup>2</sup> + 13.461 m<sup>2</sup>

Before refurbishment:

220,00 kWh/m<sup>2</sup>yr

98,00 kWh/m<sup>2</sup>yr

Primary energy demand:

148 kWh/m<sup>2</sup>yr

47 kWh/m<sup>2</sup>yr

Energy savings:

33%

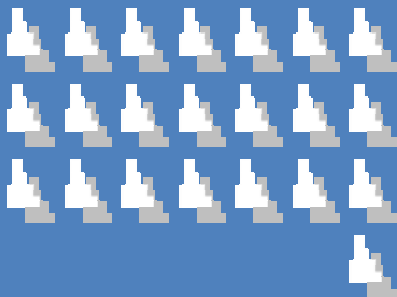
48%

Investment:

n/a

Annual savings:

n/a



**New - 2009**

*Type of building:*

**Office**

*Area:*

**12.308 m<sup>2</sup>**

**14.717 m<sup>2</sup>**

*Reference value:*

**984,30 kWh/m<sup>2</sup>yr**

**170,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**23,20 kWh/m<sup>2</sup>yr**

**122,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**97,5%**

**28,2%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Test Center: Prüffeld Nord

*Katzwanger Str. 150, 90453 Nürnberg, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: district heating, Lighting: fluorescent light bulbs with dimming.

Building envelope. Thermal insulation composite system.

## Power Generation Office Bld. 91

*Rheinstr. 100, 45478, Mülheim and der Ruhr, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: ground water heat pump (> 50 %) and condensing boiler.

Lighting: floor lamps with dimming function, upper part of blinds for daylighting.

Building envelope: heat bridge optimization, improved airtightness



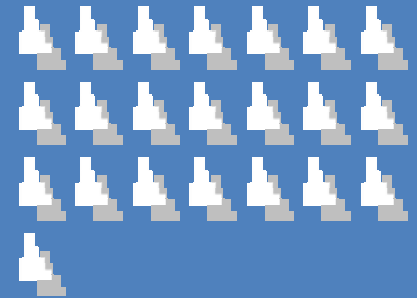
## Lindenplatz 2

20099, Hamburg, Germany

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Technical highlights: hybrid cooling towers, reducing peak loads in cooling by ice buffer storage, chillers with magnetic bearing, reduction of air change by oxygen activation, lighting concept.

New built services: central building control, frequency converter for air handling units, EIB-bus for lighting and shading control, lamps with occupation sensors and controlled dimming



### Refurbishment - 2007

Type of building:

**Office**

Area:

**16.800 m<sup>2</sup>**

Before refurbishment:

**438,90 kWh/m<sup>2</sup>yr**

Primary energy demand:

**337,00 kWh/m<sup>2</sup>yr**

Energy savings:

**33%**

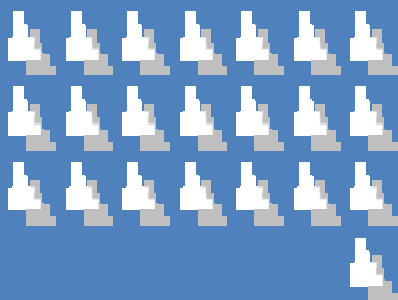
Investment:

**n/a**

Annual savings:

**n/a**

# SIEMENS



**New - 2008**

*Type of building:*

**Office**

*Area:*

**12.308 m<sup>2</sup>**

*Reference value:*

**208,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**143,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**31%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Office Building 82, BA1

*G. Scharowsky-Straße 21 91058 Erlangen, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: district heating from cogeneration heat and power plant.

Lighting: fluorescent light bulbs.

Building envelope. Thermal insulation composite system



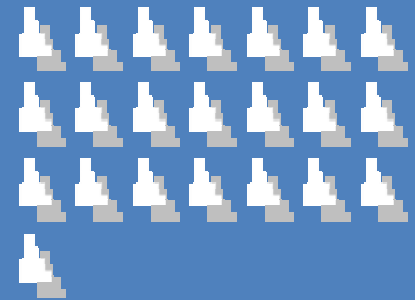


## Verwaltungsgebäude Berlin

*Nonnendammallee 101, 13629 Berlin, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Insulation of the upper floor level; Insulation of the valves (basement + control centres); Hydraulic calibration; Change to a low temperature system with flexible volume flow rates; Thermostat heads limited to set point temperature; Exchange of Thermostat valves and heads (stairways); Use of waste heat from central heat system for stairways; Time-controlled ventilation systems in bathrooms; optimisation of the ventilation system in the cafeteria.



### Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**76.525 m<sup>2</sup>**

*Before refurbishment:*

**45,50 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**33,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**26,1%**

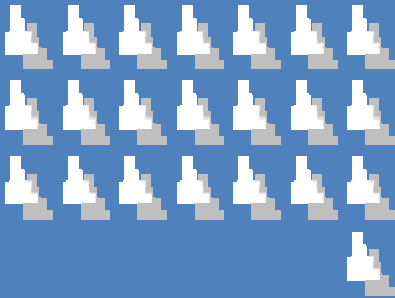
*Investment:*

**n/a**

*Annual savings:*

**n/a**

**SIEMENS**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**17.049 m<sup>2</sup>**

*Reference value:*

**298,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**181,40 kWh/m<sup>2</sup>yr**

*Energy savings:*

**39%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Düsseldorf-Airport

*Klaus-Bungert-Straße 6, 40468 Düsseldorf, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: wood pellet heating with low efficiency and primary energy optimized.

Lighting: presence detectors and shading devices venetian blinds controlled with light sensors.

Ventilation: low pressure due to optimized duct system.

Cooling: use of rotary heat exchangers to reach higher efficiency



## Siemens City

*Siemensstraße 90-92, A-1210 Wien, Austria*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: District Heating, Additional heating pump, Highly efficient control and regulation system.

Lighting: Only highly efficient lamps used in combination with light sensors.

Ventilation: Cold ceilings and free cooling.

Others: Optimization of the building envelope, Permanent sun shading.

Additional solar thermal system for hot water.



**New - 2010**

*Type of building:*

**Office**

*Area:*

**61.137 m<sup>2</sup>**

*Reference value:*

**45,40 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**31,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**30,5%**

*Investment:*

**225.000 €**

*Annual savings:*

**n/a**



## Refurbishment

*Type of building:*

**Office**

*Area:*

**1.767 m<sup>2</sup>**

*Before refurbishment:*

**362,50 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**106,90 kWh/m<sup>2</sup>yr**

*Energy savings:*

**70,5%**

*Investment:*

**2.057.000 €**

*Annual savings:*

**n/a**

## Grenoble: Building C3

*Rue de la Néva 38 000 Grenoble, France*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Panel-insulating cladding: 120 mm semi-rigid panel on a ventilated facade, including all constraints for the secondary frame and rainproof film; Frames: fixed, opening, pre-lacquered aluminium, double glazing with reinforced insulation; Sun protection with sunscreens; Glass prentice on the Southern façade.

Treatment for heating / air conditioning; Supply of the terminal units; Production of heat centralized from the existing boiling room; Ventilation of the office areas in double flux unit with high performing recovery; Regulation, management of the CVC installations with connection to the existing GTB.

Replacement of the lighting materials and new organization according to the arrangement of the premises :





## Vipiteno Office Building 1 - 2

*Via Vipiteno, 4, 20100 Milano, Italy*

Buildings are equipped with Ground Water Heat Pump (geothermal technology). Comfort cooling and heating is provided by radiant ceiling and perimeter FCUs. Renewable energy production with photovoltaic plant system.

The energy saving measures includes: improving insulation of building envelope components; reducing unwanted solar heat gains by installation of movable and permanent shading devices and control glazing; selection of energy efficient products; optimization of the regulation; selection of variable speed motors and fans and introduction of time scheduling controls.



**New – 2010**

**Refurbishment - 2009**

*Type of building:*

**Office**

*Area:*

**15.561 m<sup>2</sup>**

**7.060 m<sup>2</sup>**

*Reference value:*

**268,50 kWh/m<sup>2</sup>yr**

**104,10 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**150,10 kWh/m<sup>2</sup>yr**

**58,40 kWh/m<sup>2</sup>yr**

*Energy savings:*

**46,2%**

**43,9%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Roma Lauretina

*Via Laurentina, 455, 00142 Roma, Italy*

Total refurbishing intervention with: volumes moving from ground floor to upper floors and related slab enlargement; total replacement of facades; thermal insulation of roof and ground; completely new HVAC and electric systems.







**New - 2009**

*Type of building:*

**Office**

*Area:*

**27.027 m<sup>2</sup>**

**11.116 m<sup>2</sup>**

*Reference value:*

**220,40 kWh/m<sup>2</sup>yr**

**100,50 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**110,30 kWh/m<sup>2</sup>yr**

**62,20 kWh/m<sup>2</sup>yr**

*Energy savings:*

**50%**

**38%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Kopenhagen Towers B 408

*Ørestads Boulevard 106, 2300 København, Denmark*

## Kopenhagen Towers B 409

*Ørestads Boulevard 106, 2300 København, Denmark*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

**More effective lighting:** A proposal for the conference rooms in the conference building makes it possible to maintain an ordinary lighting of 200 lux with 3.89 W/m<sup>2</sup>. On the basis of this proposal 4W/m<sup>2</sup> will be used for 200 lux and 1 W/m<sup>2</sup> will be reserved for workplace lighting in the office areas.

**Minimizing the transmission loss** through the windows and doors in the restaurant, lobby and conference areas. The total u-value will be altered from 1.5 W/m<sup>2</sup>K to 1.2 W/m<sup>2</sup>K.

950 m<sup>2</sup> and 470 m<sup>2</sup> of solar panels will be installed. The solar panels will be placed on a south facing façade without shadowing in a vertical position. VAV control:

All the hotel rooms will have a barrier damper including necessary controls so that the individual room can be closed completely down when not in use. Installing a heating pump. The heating pump will only be used for heating rooms and will have an installed effect of 4.0 MWh, which will supply all the buildings. The heating pump will utilize the heated ground water from the ground water cooling system.





Skanska Commercial Development Nordic (SCDN) is a business unit within the Skanska Group. SCDN develops offices, business houses and logistics plants from idea to completed projects both in own direction and to external clients.

The most important significant environment aspect within the activity is energy use in our existing real estates and in those projects we initiate, develop and manage. This means that energy use is the highest prioritized environment influencing activity that is carried out.

For each project is established a project specific environment and safety program that cover functional demands and measures where the use of energy are the most central. The functional demands covers energy use, primary energy needs and generated discharges of carbon-dioxide. At the management annual review policy, objectives, targets and other vital parts of energy management is analyzed and if necessary revised.

The buildings and their systems are designed with a structure that is characterized of modularity and flexibility that facilitates adaptation to different plan solutions. Systems and components will be formulated with regard for life cycle costs and energy effectiveness. Energy use is ensured through energy simulations during the design phase and function controls of more important machines as air handling units

*Sweden*

**SKANSKA**



**New - 2008**

*Type of building:*

**Office**

*Area:*

**19.600 m<sup>2</sup>**

*Reference value:*

**119,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**89,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25,2%**



## Gårda 18:25

*Gothenburg, Sweden*

From ground floor and above the building is built as a frame of prefabricated concrete and steel with non load-bearing outer walls, covered with sheet metal, between steel pillars.

District heating and cooling supplies the building with energy for heating and cooling.

The envelope is well insulated.

There are air-handling units equipped with liquid coupled heat. Recovery and a pre-heating coil also supplying the zone coolers with free cold water.

The ventilation system is designed for low velocities and pressure drops minimising the fan electricity. The condenser heat from the chillers heats the garage floors below the building.



## Scylla 3

*Nordenskjoldsgatan and Hjälmarkajen, Malmö,  
Sweden*

Below ground floor the building is concrete founded. From ground floor and above it's built as a frame of prefabricated concrete and steel with non load-bearing outer walls between steel pillars. The envelope is well insulated.

District heating and cooling supplies the building with energy for heating and cooling.

There are air-handling units equipped with liquid coupled heat recovery and a pre-heating coil also supplying the zone coolers with free cold water.

The ventilation system is designed for low velocities and pressure drops minimising the fan electricity. The garage floor below the building has a separate air-handling unit. The garage is supplied with used air from the main air-handling units. The condenser heat from the chillers heats the garage floors below the building



**New - 2009**

*Type of building:*

**Office**

*Area:*

**15.960 m<sup>2</sup>**

*Reference value:*

**110,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**83,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25%**





New - 2010

New - 2008

Type of building:

Office

Area:

12.250 m<sup>2</sup>

49.000 m<sup>2</sup>

Reference value:

356,00 kWh/m<sup>2</sup>yr

113,30 kWh/m<sup>2</sup>yr

Primary energy demand:

89,00 kWh/m<sup>2</sup>yr

85,00 kWh/m<sup>2</sup>yr

Energy savings:

75%

25%



District heating and cooling supplies the building with energy for heating and cooling. The envelope is well insulated.

There are large air-handling units equipped with liquid coupled heat recovery and a pre-heating coil also supplying the zone coolers with free cold water.

The ventilation system is designed for low velocities and pressure drops minimising the fan electricity. The condenser heat from the chillers heats the garage floors below the building.

## Sturegatan 1

*Sweden*

Built with a frame of prefabricated concrete and steel with non load-bearing outer walls between steel pillars.

## Hagaporten 3

*Solna, Sweden*

Bottom flat is founded with concrete, above, a frame of prefabricated concrete and steel, ceiling structure of wood with surface stratum off plate and sedum, surface stratum in façade is constituted of concrete and glass.







## Österport 7

*Sweden*

The building use district heating. The ventilation system supplies fresh air and reuse the heat from the exhaust air. The building is used during normal office hours. To reduce the buildings energy consumption with 25%, all the crucial systems must be optimized.

Calculations show that it possible to reach the goal if the following components are combined:

Light: install motion- and acoustic-sensors,

Heat: Fine tune the system and change pumps,

Ventilation: Fine tune the system and change fans,

Air-condition: Fine tune the system and change pumps,

Roof: More insulation on the roof, Tenants;

Educate personnel to increase the understanding of how the building work.

### Refurbishment - 2011

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**235,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**174,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**26%**





**New - 2009**

*Type of building:*

**Office**

*Area:*

**18.836 m<sup>2</sup>**

*Reference value:*

**179,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**85,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**52,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Skanska Nordica

*Ceskobratrska, Ostrava, Czech Republic*

Heating of the building will be provided by centralised district heating. The source of heat is the junction exchange station water/water placed in the 2nd basement, which is connected to the warm water supply pipe from the centralised district heating.

Cooling of the building will be provided by central cooling source. There are two cooling units projected as the cooling source for cooling of water. The cooling units are equipped with water-cooled condensers and screw compressors for the instalation in the machine-room. The units are cooled with water by the help of dry-type coolers placed on the roof of the building.

There are projected devices for hot-air ventilation and cooling of entrance areas, canteen including facilities, office spaces and leaseable spaces for the ensuring of microclimate conditions inside the building according to the character of the usage of the particular spaces.

Warm water preparation is provided by warming-up through a plate exchanger in the house delivery station with an allocated storage reservoir for the time of high consumption period placed in the junction exchange station.

The illuminating systems will be carried out in the standard way, providing the hygiene conditions of illuminance of the given spaces and standards.



## Népliget Center

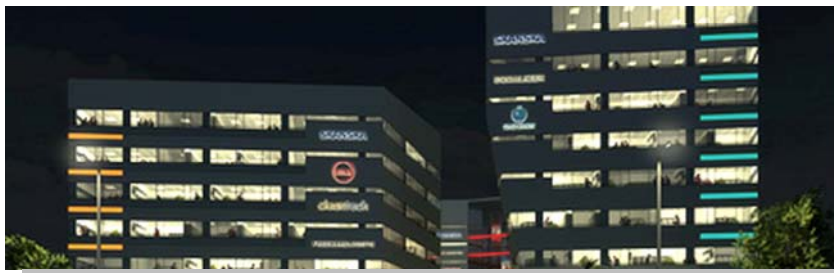
*Hungary*

The value of the heat transmission coefficient of boundary structure is 25 % below the national standard, the glass structure with frame is 14 % below the national standard and the value of the heat loss coefficient is 17% below the national standard. The average glazing ratio of the building compared to the net façade boundary ratio is 37%.

3 chiller cooling system has been installed to prepare 10 °C water for fan-coil units and cooling coils for air handling units. A fan-coil system is installed for heating and cooling and the electricity supply of the fan-coils system is connected to the meters of each tenant. Fan-coils are connected to time channels. Proportional sector of thermostats is 2K. A free cooling unit was installed in building A. The free cooler works if the outside temp is lower than 7 C and there is a cooling load need in the building. The velocity of the air ducting system is 3m/s mostly and in the shaft it is 4.5 m/s, in other words a low pressure drop system. Low temperature boilers have been selected for low emissions.

The building is equipped with solar panels for domestic hot water (DHW). According to the provider, this saves app. 8000kWh/yr. In building A the solar system is dimensioned for 5 m3 daily DHW consumption.

Office lighting is mainly provided in the form of T5 type fluorescent-tube fittings and fittings for compact fluorescent tubes. All lighting of the common areas are connected to the BMS system and adjusted according to the time channel.



**New - 2007**

*Type of building:*

**Office**

*Area:*

**9.200 m<sup>2</sup>**

*Reference value:*

**132,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**98,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25,7%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2009**

*Type of building:*

**Office**

*Area:*

**15.371 m<sup>2</sup>**

*Reference value:*

**173,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**121,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**27%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Lintulahti Office

*Helsinki, Finland*

The chosen heat source in Lintulahti is district heating (co-generation of heat and electricity), the primary strategy for cooling is to district cooling and whenever it is possible to use free cooling herewith minimizing the need for district cooling.

The building windows are designed with adjustable shades mitigating excessive temperature increases by solar radiation during wam and sunny days and herewith reducing the need for cooling energy.

The building envelope is well insulated. Since windows represent the highest heat losses during cold months, low emissivity windows are used.

The electricity use of the ventilation system is minimised by designing low-pressure drop ducts and by using ventilation units with low specific fan power. Fresh air amounts are controlled with schedules and switches, thus the zones always have fresh air when occupants arc present.

For lightning, movement and natural lightning sensors are used to keep the use of artificial light minimal but still maintaining comfortable conditions.



## Alfa

Denmark

The buildings heat source is a natural gas boiler, the primary cooling strategy uses free cooling whenever possible. Furthermore, the windows are designed with sun reflecting coating which reduces excessive temperature increases by solar radiation and hereby reducing the need for cooling energy.

The building envelope is well insulated. Since the windows represent the biggest heat loss, low emissivity windows are used.

The electricity use of the ventilation system is minimized by low-pressure drop ducts with ventilation units with a low Specific Fan Power. The supplied fresh airflow rate is timedependent controlled, so that the occupied zones are always supplied with fresh air when the occupants are present. Movement and natural lighting sensors are used to keep the use of the lighting systems as low as possible with regard on comfortable conditions.



New - 2009

*Type of building:***Office***Area:***3.651 m<sup>2</sup>***Reference value:***95,80 kWh/m<sup>2</sup>yr***Primary energy demand:***67,10 kWh/m<sup>2</sup>yr***Energy savings:***30%***Investment:***n/a***Annual savings:***n/a**





**New - 2010**

*Type of building:*

**Office**

*Area:*

**24.426 m<sup>2</sup>**

*Reference value:*

**98,40 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**72,80 kWh/m<sup>2</sup>yr**

*Energy savings:*

**26%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Havneholmen Tower

*Havneholmen 25, 1561 Copenhagen, Denmark*

Heat source is district heating, which is efficient and environmental friendly (district heating in Copenhagen is a bi-product for garbage-incineration plants).

Triple-glazing in North facades with a U-value of 0.8 W/m<sup>2</sup>K for the glass and 1.17 W/m<sup>2</sup>K for the total window, subsequently reducing the heat loss in the heating season. Double-glazing in East, South and West facades with a U-value of 1.1 W/m<sup>2</sup>K for the glass and 1.5 W/m<sup>2</sup>K for the total window. Insulation thickness in walls are 175 mm with U-value of 0.22 W/m<sup>2</sup>K and on roof 260 mm with U-value of 0.25 W/m<sup>2</sup>K.

The cooling is produced in traditional electrical powered cooling compressors for ventilation aggregates and for cooling beams situated in suspended ceilings. Cooling beams are designed to operate with relatively warm cooling water, thus enabling the cooling-water to by-pass the compressor and utilize the cold air-temperature in autumns and spring (free cooling).

The BMS-system is programmed so the ventilation-systems run for a limited period on cool summer nights thus flushing the generated heat out of the building.

Movement and natural lighting sensors are used to keep the use of the lighting systems as low as possible within the conditions set for a comfortable work environment.

Requirements for tenants energy consumption are: each work-station is allowed 1 no. pc with a maximum effect of 150W; basic ceiling lighting and desk lamps are allowed a total maximum effect of 6 W/m<sup>2</sup>; stand-by effect on all office utilities including photocopier, printers, coffeemachines etc. is reduced to an absolute minimum.

## BCG48

*Borgmester Christiansens Gade 48, 2450 København,  
Denmark*

Heat source is district heating, which is efficient and environmental friendly (district heating in Copenhagen is a bio-product for garbage-incineration plants).

Triple-glazing in North facades with a U-value of 0.8 W/m<sup>2</sup>K for the glass and 1.5 W/m<sup>2</sup>K for the total window, subsequently reducing the heat loss in the heating season. Double-glazing in East, South and West facades with a U-value of 1.1 W/m<sup>2</sup>K for the glass and 1.5 W/m<sup>2</sup>K for the total window. Insulation thickness in walls are 175 mm with U-value of 0.22 W/m<sup>2</sup>K and on roof 260 mm with U-value of 0.25 W/m<sup>2</sup>K.

The cooling is produced in traditional electrical powered cooling compressors for ventilation aggregates and for cooling beams situated in suspended ceilings. Cooling beams are designed to operate with relatively warm cooling water, thus enabling the cooling-water to by-pass the compressor and utilize the cold air-temperature in autumns and spring (free cooling).

The BMS-system is programmed so the ventilation-systems run for a limited period on cool summer nights thus flushing the generated heat out of the building.

Movement and natural lighting sensors are used to keep the use of the lighting systems as low as possible within the conditions set for a comfortable work environment..



**New - 2010**

*Type of building:*

**Office**

*Area:*

**13.390 m<sup>2</sup>**

*Reference value:*

**194,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**87,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**55%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**19.680 m<sup>2</sup>**

*Reference value:*

**438,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**325,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**26%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Atrium City

*Jana Pawła II Avenue, Warsaw, Poland*

Low energy consumption is result of various technical solutions employed in the building like:

The balanced ratio of glassed and insulated parts contributes to the saving of energy costs. The building has a compact shape and thick insulation has been used during the construction. Much emphasis has been also put on air-tightness of building envelope. Glazed facade with low thermal transmittance factor  $U = 1,1 \text{ W/m}^2\text{K}$  – for glazing and  $1,41 \text{ W/m}^2\text{K}$  for window.

Heat recuperation system in Atrium City is an average 60%. Additionally, building HVAC system reuse air extracted from office space (which is clean enough) to heat atrium and garage floors. In this way, air can be used repeatedly, eliminating the need to heat up a garage.

The sufficient share of natural light and use of more efficient lighting also contributes to higher overall efficiency of the building. Office lighting is mainly provided in the form of T5 type fluorescent tube fittings and fittings for compact fluorescent tubes. All lighting in the common areas is connected to the Building Management System and its intensity is adjusted according to time channels.

Air conditioning system in the building is based on chilled beams because of the lower amount of electricity required and the comfortable indoor climate conditions



## Grunwaldzki Center Building A

*50-374, C.K.Norwida, Wrocław, Poland*

Grunwaldzki Center consumes around 30 percent less energy than the Polish standards, which makes direct financial savings for the tenants of the building in reduced energy costs. The energy efficiency measures have been made at no additional cost to the tenants.

The building is equipped with an advanced BMS (Building Management System), which manages the HVAC system and all the indoor parameters to ensure optimal energy consumption. The BMS has energy saving functions such as separate day and night modes.

Heat recovery systems in the air handling units recycle 90 percent of the energy from the outgoing air on average and outgoing warm air is recirculated through the garage levels to avoid the need for space heating.

Electric water heaters have been installed under every sink to provide on-demand warm water. The water heaters are more efficient than a conventional warm water system.

Grunwaldzki Center is also equipped with efficient lighting, windows with low U values, minimal exterior lighting, movement sensor lighting controls in the garage and communal areas, and HVAC zoning that enables heating and ventilation to be optimized in individual rooms.



### New

*Type of building:*

### Office

*Area:*

**21.767 m<sup>2</sup>**

*Reference value:*

**307,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**191,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**37,6%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New**

*Type of building:*

**Office**

*Area:*

**9.189 m<sup>2</sup>**

**8.099 m<sup>2</sup>**

*Reference value:*

**267,00 kWh/m<sup>2</sup>yr**

**326,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**179,00 kWh/m<sup>2</sup>yr**

**211,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**33%**

**35%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Grunwaldzki Center Building B

*50-374, C.K.Norwida, Wrocław, Poland*

## Grunwaldzki Center Building C

*50-374, C.K.Norwida, Wrocław, Poland*

A district heating house substation with heat exchanger will function as a heat source for the building. Heat will be supplied to the radiator central heating system, underfloor central heating system and technological heat system (heaters in air handling units and heating and ventilation units).

In winter, relative humidity will be controlled only in office space and it will be maintained at 40%. Chill will be supplied from a set of chillers with total capacity of 926 kW. Chill will be supplied by chilled water circulation to cooling coils at air handling units and to the circulation of fan-coils. Chillers were adjusted both to operation and standstill in winter. Building envelope insulation.





## Marynarska Point B1 and B2

*Postepu 15c, 02-676, Warsaw, Poland*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Ducting and cooling pipes are sized for very low velocities (low pressure = low energy consumption). Fans in AHUs are sized for low SFP-factor ( $<2,0 \text{ kW/m}^3/\text{s}$ ), which means low energy consumption. Pumps are selected with high efficiency factor. Chillers are selected for a high COP-factor. Boilers are selected for high efficiency and low emissions. Heat recovery systems are used in AHUs. For offices heat recovery efficiency not less than 70%. For Kitchen/Canteen not less than 40%. Frequency converters are used for pump- and fan motors (with some minor exceptions).

Exhaust air from office premises is, after having been heat recovered to the office fresh air, used to ventilate and heat the garage premises. Fresh air rates are thoroughly investigated to match as well hygienic – as energy requirements.

When selecting façade material, windows, external blinds, etc... the energy consumption is highly considered in order to limit the heating/cooling plant power and energy consumption.

As refrigerant in chillers only R 134a is used, for keeping the cooling energy consumption on a low level. Thermostatic valves are used as a general concept for radiators. All fresh air is filtered. We do not allow glass fiber in silencers. Free-cooling (ventilation during night/early morning hours) implemented to utilize colder temperatures during nights.



**New - 2009**

*Type of building:*

**Office**

*Area:*

**26.500 m<sup>2</sup> + 30.000 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**32%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2005**

*Type of building:*

**Office**

*Area:*

**620 m<sup>2</sup>**

*Reference value:*

**21,60 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**6,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**71,8%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Solux GmbH

*An der Stiftsbleiche 1, 87439 Kempten, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

**Heating:** Reduction of heating demand based on optimized solar adjustment and utilization. Ventilation system with heat recovery efficiency of 72%. Installation of a Brine-Water heat pump connected to a thermal activated ground plate.

**Lighting:** Usage of 161 fluorescent lamps with electronical power supply unit. Optimized control of the exterior lighting by reason of clock timers and brightness sensors.

**Building envelope:** Insulation below the ground plate, timber frame construction (exterior wall), installation of low energy house windows (3-pane-insulated-glazing).

**Renewables:** Usage of geothermal and solar energy .





## Sparkasse Herford, Altbau

*Engerstraße 21, 32051 Herford, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

**Heating:** Optimizing the volume flow and system temperatures in the heating pipe network (old building); Installation of a gas condensing boiler; Switching off the heat supply during the summer month (old building).

**Lighting:** Installation of photovoltaic systems and usage of efficient illuminants.

**Air treatment:** Refurbishment of all systems (better air treatment). Minimization of fan durations. Optimized controlling of power consumption.

**Cooling:** Installation of frequency controlled pumps. Electronic counter for targeted controlling. Sufficient insulation of pumps and pipes (EnEV 2009).

**Climatization:** Reducing of the interior thermal loads. Minimize of the additional heat inputs.



### Refurbishment - 2009

*Type of building:*

**Office**

*Area:*

**2.278 m<sup>2</sup>**

*Before refurbishment:*

**226,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**148,90 kWh/m<sup>2</sup>yr**

*Energy savings:*

**34,2%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2009

*Type of building:*

**Office**

*Area:*

**385 m<sup>2</sup>**

*Before refurbishment:*

**255,90 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**144,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**43,7%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Sparkasse Herford

*Bahnhofstraße 103, 32584, Löhne, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

The existing building for Sparkasse Herford (saving bank), Agency Löhne, is a 2- level building of a massive construction with basement, flat and roof. Aluminium- windows, Gas- heating, boiler for warm water, no ventilation or air- condition.

Measure for renovation: thermal insulation composit system on external walls; replacement of windows and exterior doors; insulation of flat roofs.





## Ludwigshafen

*Ludwigstraße 52, 67059 Ludwigshafen, Germany*

The building is a high rise building constructed in 1974. The ground floor, the first and the second floor were built with concrete. The third to 12th floor were constructed as a steel structure. The facade is a curtain wall of metall and glas with windows that cannot be opened. Within the refurbishment process the facade will be renewed and "second skin" facade will be applied. The venitlation system will be exchanged and new control systems installed. The users will also be trained to use energy in a more efficient way.

Heating: via the ventilation systems.

Ventilation: ventilation system with heat recovery.

Lighting: special blinds to shade the interior; day light control.

Building envelope: double façade; the normal solar radiation is used to warm the air between the two facades; this warmed air is sucked in by the ventilation system.



### Refurbishment - 2009

*Type of building:*

**Office**

*Area:*

**6.490 m<sup>2</sup>**

*Before refurbishment:*

**114,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**41,10 kWh/m<sup>2</sup>yr**

*Energy savings:*

**64%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment - 2008

*Type of building:*

**Educational**

*Area:*

**n/a**

*Before refurbishment:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**39%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## High school

*Karlovac County, Croatia*

For the high school, a range of measures were implemented, like instalation of new energy efficient windows, new light fuel oil boiler, automatic regulating valve, thermostatic regulation valves on radiators, recirculation pump in SHW system.

(In Croatia there are no legal values for primary energy and all calculations and comparisons were made based on heat energy demand.)





## City Hall Walldorf

*Westendstraße 8, 64546, Mörfelden-Walldorf,  
Germany*

The City Mörfelden-Walldorf has been part of the Climate Alliance since 1992 and is therefore implementing energy saving measures. The building was insulated with super-insulation panels, new windows were applied, the heating system was modernised and the building obtained a ventilations system with heat recovery.

Insulation: curtain wall with 12 cm mineral rock wool (hall roof), super insulation windows with  $U=1,3$ , insulation of the flat roof, addition of another floor - build according to an high efficient energy standard.

Electricity: energy saving lighting, control according to demand, exchange of decentralized warm water supply, connection to a central warm water supply system, ventilation fans and pumps are regulated according to demand, sanitarian equipment run without electricity, energy saving office equipment, air conditioning of server room, high percentage of day light.

Building Technology: automated heating system, ventilation system with heat recovery, weather contrld summer heat insulation, night cooling with natural ventilation.



### Refurbishment - 2002

*Type of building:*

**Institutional**

*Area:*

**3.107 m<sup>2</sup>**

*Before refurbishment:*

**294,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**75,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**75%**

*Investment:*

**570.007 €**

*Annual savings:*

**n/a**



## Refurbishment - 2003

*Type of building:*

**Institutional**

*Area:*

**4.525 m<sup>2</sup>**

*Before refurbishment:*

**273,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**110,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**60%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Bürgerhaus

*Mörfelden-Walldorf, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: combined heat and power unit (gas) 12,5 kW (thermal) 53,5 kW (electric).

Lighting: energy saving with new lighting.

Building envelope: super-insulation panel 12—20 cm (type 035) new windows: U: 1,3 W/(m<sup>2</sup> K).

Ventilation: ventilation system with heat recovery.

Other measures: sun-screen, overnight cooling system.



## Kindertagesstätte

*Philipp-Körber-Weg 2, 90439, Nürnberg, Germany*

The building was to be transformed into a nursery school and an information centre. In the context of the refurbishment, a special focus was put on the building's thermal insulation.

The following measures were planned: Erection of a 2-storey outbuilding and refurbishment of the existing building with new finishings, Installation of an efficient gas condensing boiler for heating and warm water supply (80 kW, 350 Litre storage tank), Floor heating in ground floor and first floor with single room regulation, steel panel radiators in the other floor, installation of water saving sanitary equipment, Installation of energy saving fluorescent tubes with electronic ballasts.

Thermal protection in the existing building, all exterior elements were enhanced with thermal insulation. The outbuilding was constructed in the regular standard of thermal insulation for new buildings with state-of-the-art thermal insulation.



### Refurbishment - 2002

*Type of building:*

**Educational**

*Area:*

**1.473 m<sup>2</sup>**

*Before refurbishment:*

**104,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**70,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**32,5%**

*Investment:*

**3.555 Mio.€**

*Annual savings:*

**n/a**





## Refurbishment - 2008

*Type of building:*

**Educational**

*Area:*

**4.082 m<sup>2</sup>**

*Before refurbishment:*

**271,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**70,50 kWh/m<sup>2</sup>yr**

*Energy savings:*

**74%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Vocational School Haarentor

*Ammerländer Heerstraße 33 – 39, 26129 Oldenburg,  
Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: basic load wooden pellet boiler, peak load gas condensing boiler.

Ventilation: ventilation system with heat recovery 65%.

Lighting: Fluorescent light bulbs; day light control, motion control inside rooms.

Building envelope: 16 cm thermal insulation composite system,  $U = 0,14 \text{ W/m}^2\text{K}$ ; Windows: double-pane insulation windows with insulated; frames,  $U = 1,1 \text{ W/m}^2\text{K}$ ; Roof: 22 cm mineral wool,  $U = 0,17 \text{ W/m}^2\text{K}$ .







## Stockholms Observatorium

*Stockholm, Sweden*

The major measure is to convert from oil and direct electric heating to heat pumps. A culvert system between the buildings exists and will be used.

Except the conversion to heat pumps different measures in the different buildings will be made concerning the ventilation.



### Refurbishment - 2007

*Type of building:*

**Institutional**

*Area:*

**n/a**

*Before refurbishment:*

**643,00 MWh/yr**

*Primary energy demand:*

**141,00 MWh/yr**

*Energy savings:*

**78%**

*Investment:*

**3.555 Mio.€**

*Annual savings:*

**n/a**



## Refurbishment

*Type of building:*

**Institutional**

*Area:*

**7.700 m<sup>2</sup>**

*Before refurbishment:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**6,1 kWh/m<sup>2</sup>yr**

*Investment:*

**81.000 €**

*Annual savings:*

**n/a**

## Svartsjö/Färingsö

*Sweden*

Domestic hot water, earlier heated by oil, has been replaced by solar heating with reduced use of electricity for peak loads.

The buildings at Svartsjö and Färingsö are heated with wood chips. Due to the large furnace the efficiency is low most of the year. Therefore in summertime a smaller oil furnace heated the buildings. Times when only tap water heating was required the water was electrically heated in each building. The oil furnace provided the buildings with heat by an 800-meter long culvert system. In summertime the heat loss from the culvert was significant. The loss from the system was 43MWh/month and the load required from the buildings was 25MWh/month heat for tap water. Thus almost 70MWh/month had to be produced.

The company has an energy policy for operation and maintenance of the buildings. For example the company itself produces the wood chips used for heating. The ambition was to increase the use of renewables. There was also a possibility to receive financial support from the government for installation of solar collectors. Thus solar collectors were installed to produce the heat needed for tap water in summertime. The property in Svartsjö got 143 m<sup>2</sup> and Färingsö 91 m<sup>2</sup> solar collector area installed respectively. 2 buildings were connected and provided with hot water. Savings were achieved by the renewable production of heat and by avoiding the losses in the culvert. Since the oil heating was not used the personal costs for operation of the furnace was also reduced.





## Carlstens fästning

Sweden

Carlsten is a stone fortress located on the western coast of Sweden about 45 km northwest of Göteborg. In 1658 King Carl X Gustaf ordered the construction of the fortress at the top of Marstrand island. Today the fortress has guided tours, conferences, fortress events, museum, restaurant and overnight stays in the fortress hotel.

The energy-reducing efforts concerns a major part of Carlstens fortress called Redutten, Inre kasern and Yttre kasern.

In the end of 2008 the oil furnace in Redutten and Inre Kasern, and the electric boiler in Yttre kasern was each replaced with geothermal heat pumps. Fans for air heating and recirculation was replaced with energy efficient recirculation fans and heat water radiators

Redutten was built in stages starting in the end of the 17th century and was finished in it's present appearance 1860. Inre and Yttre Kasern was built in the late 18th century. Redutten, Inre and Yttre Kasern is built entirely in granit (stone). It consists in a total of 3.756 squaremeters. The total area of Carlstens Fortress is 10.574 sq.meters and about 35% of this area is heated.



### Refurbishment - 2007

*Type of building:*

**Institutional**

*Area:*

**n/a**

*Before refurbishment:*

**178,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**101,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**43%**

*Investment:*

**3.555 Mio.€**

*Annual savings:*

**n/a**



**New - 2011**

*Type of building:*

**Office**

*Area:*

**n/a**

*Reference value:*

**266,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**40,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**85%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Homebase

*Belgium*

The building will be certified as a 'Passive house' concept and will be characterised by: very good insulation of the building envelope e.g. 36 cm roof insulation of mineral wool; very airtight building envelope that will be proved via a 'blower door test'; heat recovery with a high efficient heat recovery unit (efficiency = 90%); 'heating/cooling via heat pump and heat/cold emission via 'concrete core activation'. The heat is exchanged with the soil via a 'Borehole energy storage' (boreholes of 120-160 m depth).

All fossil energy resources are excluded; a PV installation that will produce 125% of the building's energy need. The 85% energy savings presented above thus is most probably a conservative estimation; recovery of rainwater and natural draining of surplus rain water.





## Neubau - Produktion

*Dahlkamp 6, D-46354, Südlohn, Germany*

Compact new building for production and storing in the ground floor and management in the first floor. The business of the firm is the wholesale trading of poultry (some other fresh foods like venison and eggs). The fresh or frozen products are packaged and distributed in several cooled rooms.

The optimization of the components of the building envelope was in the focus, mostly by improving insulation. The cooling of parts of the building is used for the production processes.

Energy for this processes is not documented in this paper, because DIN V 18599 doesn't consider the production processes.



### New - 2010

*Type of building:*

### Industrial

*Area:*

**1.714 m<sup>2</sup>**

*Reference value:*

**165,50 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**75,30 kWh/m<sup>2</sup>yr**

*Energy savings:*

**54,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



strömberg



### Refurbishment - 2007

*Type of building:*

**Industrial**

*Area:*

**n/a**

*Before refurbishment:*

**55,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**40,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**27%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Jordbromalm 4:10

*120 88 Stockholm, Sweden*

Strömberg is certified according to ISO-14001 and ISO-9001 since the late 90s and have an environmental strategy since then.

Strömberg follows the guidelines for developing an energy management system. We have implemented it to our existing comprehensive management systems for quality and environment.

The warehouse is heated with drill holes connected to a heat pump. Low energy use because of the design of the building.



## Bergums Kyrka

Sweden

The church is built in the 13 th century. In the end of 2008 the oil furnace which heated the supply air was replaced with a geothermal heatpump in order to reduce the energy consumption.

The Swedish Church in Gothenburg will in the coming years ahead be implementing new, energy efficient technology in order to replace fossile-based fuels and electric-powered boilers. In addition to this, the heating systems are being tuned and ventilation units serviced and possibly replaced if found inefficient.



### Refurbishment - 2008

*Type of building:*

**Religious**

*Area:*

**n/a**

*Before refurbishment:*

**234,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**102,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**56%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2008

*Type of building:*

**Religious**

*Area:*

**n/a**

*Before refurbishment:*

**172,30 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**96,20 kWh/m<sup>2</sup>yr**

*Energy savings:*

**44%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Billdals Kyrka

*Sweden*

The church is built in 1992 and it is modern regarding building construction. In the end of 2008 the oil furnace was replaced with a geothermal heatpump and sun-collectors was installed on the roof in order to reduce the energy consumption. The result was a 44% reduction of used energy for heating and hot water production compared to 2007.



## Västra Frölundas Kyrka

*Sweden*

The church was built in 1866. In the end of 2006 the oil furnace was replaced with a geothermal heat pump in order to reduce the energy consumption.



### Refurbishment - 2006

*Type of building:*

**Religious**

*Area:*

**n/a**

*Before refurbishment:*

**238,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**103,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**56,8%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Industrial**

*Area:*

**1.885 m<sup>2</sup>**

*Reference value:*

**300,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**203,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**32,2%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Handwerkerhof Eching

*Erfurter Straße 14, 85386 Eching, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Heating: Floor heating system.

Building envelope: Exterior Walls: Thermal insulation composite system 22cm WD040; Roof: 14 cm WD040; Exterior Facade: Metal panel, d=80 mm; Insulation Basement, 6cm WD040; Sectional Doors: U=1,6 W/m<sup>2</sup>K.



**TEDI**

GmbH



## TEDI Moordorf FM 01

*Marktstraße 16a, 26624, Sübbrookmerland, Germany*

## TEDI Mainhardt FM 02

*Im Seetal 13, 74535, Mainhardt, Germany*

The TEDI in Sübbrookmerland is a small retail unit. TEDI is a 1 € -Discount. With the use of an efficient ventilation, heating and cooling system in conjunction with an optimized shell we are sure to have the correct ration between costs and efficiency.

Building envelope: Reducing unwanted solar heat gains, By installation of permanent shading devices; Changing/ Installation type of glazing, Clear double glazed unit (6mm float + 12mm air + 6mm float); Changing/Installation: type of frame, Plastic; Improving insulation of opaque external walls, opaque external roofs, ground floor, vertical windows or/and transparent façades.

Heating system: Optimisation of the regulation, Activation of night-drawdown. Cooling system: System based on water distribution, Control on the returns at 7/12.



**New - 2010**

*Type of building:*

**Commercial**

*Area:*

**505 m<sup>2</sup>**

**530 m<sup>2</sup>**

*Reference value:*

**294,00 kWh/m<sup>2</sup>yr**

**263,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**125,60 kWh/m<sup>2</sup>yr**

**125,40 kWh/m<sup>2</sup>yr**

*Energy savings:*

**53,7%**

**52,3%**

*Investment:*

**40.000 €**

**40.000 €**

*Annual savings:*

**n/a**





**New - 2009**

*Type of building:*

**Educational**

*Area:*

**1.195 m<sup>2</sup>**

*Reference value:*

**115,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**73,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**36,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Ljungbacken Förskola

*Sweden*

## Kaxberg Förskola

*Sweden*





## Hölö Förskola

*Sweden*

The premises for the three schools are to have a design according to Södertälje school model and adhere to the Telge energy and environmental policy.

The buildings is supplied by district heating and a rotary heat exchanger and distributed through floor heat systems. Low energy use is secured mainly through efficient heat recovery and low heat losses through exterior surfaces and thermal bridges.



**New – 2009**

*Type of building:*

**Educational**

*Area:*

**1.195 m<sup>2</sup>**

*Reference value:*

**115,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**50,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**56,5%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## **Refurbishment - 2008**

*Type of building:*

**Commercial**

*Area:*

**1.551 m<sup>2</sup>**

*Before refurbishment:*

**321,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**224,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**30%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## **Tengelmann Klimamarkt**

*Wissollstraße 60, 45478, Mülheim an der Ruhr,  
Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

**Heating:** geothermal heat pump with six drillings of 130 m depth connected to a plumbing system; the liquid absorbs the ground's heat; usage of the exhaust air of the store's refrigeration units for warm water.

**Air conditioning:** cooling with the geothermal heat pump, the liquid absorbs the heat and transfers it into the ground.

**Lighting:** using daylight: glass belts with multi dispersive glass in the roof; LED lighting.

**Renewables:** photovoltaic panels: 1140 m<sup>2</sup>- electricity production 45.000 kWh.





## Terme Snovik

*Snovik NN, 1219, Laze v Tuhinju, Slovenia*

The existing central building, where the covered pool with the water area is located, is insulated and has big glazed areas meant for passive solar heating of the indoor pool.

Ventilation is performed by waste air heat recovery. Besides indoor pool complex in the summer season also outdoor water entertainment area with 500 m<sup>2</sup> of water surface is used. To cover heat needs of outdoor and indoor pool complex about 155.000 l LPG is used annually. To achieve additional savings heat pumps water/water and air/water and a solar heating system with vacuum solar receivers were installed in 2004. Thus achieved heat is used for hot sanitary water preparation and heating-up of thermal pool water of the indoor pool, in the summer season also of the outdoor pool. Heat pumps: Exploitation of heat of waste water, which is collected in the day reservoir. The device consists of two independent units equipped with DDC regulation, which together forms 73 kW of heat power and in average daily pump 75 m<sup>3</sup> of waste water. To exploit surplus heat, which appears by operation of cooling compressors, a heat pump air/water, 10 kW of heat power, with DDC regulation and sensors is installed. In both cases water with input temperature 24°C is heated to 40°C.

Solar heating system: 24 vacuum solar collectors with total net surface of 81 m<sup>2</sup> are set. The system includes two heat exchangers. In the primary part, from solar energy receivers to heat exchangers, glycol serves as a medium for heat transfer, in the secondary part from heat exchangers to heat consumers the medium is water.



### Refurbishment - 2004

*Type of building:*

**Leisure**

*Area:*

**2.700 m<sup>2</sup>**

*Before refurbishment:*

**425,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**234,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**45%**

*Investment:*

**210.000 €**

*Annual savings:*

**42.000 €/yr**





## Refurbishment

*Type of building:*

**Office**

*Area:*

**425 m<sup>2</sup>**

*Before refurbishment:*

**83,10 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**37,40 kWh/m<sup>2</sup>yr**

*Energy savings:*

**68%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Historical Building

*via Forcella, 12, 25064, Gussago, Italy*

The building will integrate passive energy measures with an optimized envelope, highly efficient heating and cooling systems including a solar thermal and a PV power plant.

Due to some historical prescriptions in building facade, it has not been allowed to realize a continuous external insulating layer so that the thermal transmittance has been reduced by adding an insulating mortar and reducing thermal bridges. The main reduction of building energy demand has been achieved implementing a ventilated and high insulated roof and high insulated basement. The large transparent facade will adopt LoE double glazing with argon fill and metal frame with thermal break. External curtains will provide solar control in summer, while indoor curtains will be used to avoid glare effects.

Heating and cooling loads will be satisfied by a reversible heat pump with ground heat exchanger. Winter nominal COP is 4.5. The distribution system consists of low temperature radiant pannels and of air ventilation system with heat recovery.

6 m<sup>2</sup> of solar collectors to assist heating system and produce hot water. Furthermore, a PV power plant of 4.5 kW will be installed.





# Hauptverwaltungsgebäude Nordstern

*Nordsternplatz 1, 45899, Gelsenkirchen, Germany*

The original construction concept of a curtain wall steel frame construction with brick filled half-timbered fields was transcribed. The suspended modules either bear a panel or a window. The wall panels have a visually and acoustically designed inner surface, an air layer and a supporting plate with a brick belt. The windows are superinsulations countercash windows. A special feature is the load bearing structural design of the courtyards and glass roofs. A 50°C air flow through rectangular tubes compensates the facade's energy loss.

Climate Control Technology: The pit gas that was released into the atmosphere before the reconstruction is now used for the energy supply of the new headquarters.

Heating systems: In addition to the combined heat and power plant the energy needed for heating the office buildings is provided by a facade and floor heating, convectors and panel radiators.

Air conditioning: A mechanical ventilation system with heat recovery and energy efficient air-conditioning systems provide fresh air, decent temperatures and a comfortable humidity level.



## Refurbishment - 2003

*Type of building:*

**Office**

*Area:*

**14.252 m<sup>2</sup>**

*Before refurbishment:*

**318,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**65,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**79,5%**

*Investment:*

**45.000.000 €**

*Annual savings:*

**n/a**



**New - 2007**

*Type of building:*

**Office**

*Area:*

**17.151 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**39-44%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Millenium Tower I

*Budapest, Hungary*

The Millennium Tower I. building is equipped with a "Forced Interactive Wall" consisting of curtain wall panels with pre-fitted glasses. Floor high complete panel window system, with a typical size of 1350/3700 and 1500/3700 mm. The window units are made of extruded aluminium profiles, hidden into a structured aluminium frame with a four side glassing. A single layered framed glass is also built into this frame structure, making the interactive façade complete. For avoiding cold bridges, the sealants of glass holding frames are connected to each other. The window divisions transfer the loads onto the aluminium brackets, which are anchored with mild steel to the reinforced concrete slab. The structure only needs one support canteliver per a floor high window. All window structures are transparent, with water clear glasses from the floor to the ceiling. A 25 mm, silver colored, motorized shades are found in the outer air chamber. The control of the automatic louvers can always be manually over judged by the user from the office areas.

The waste- and rain water sewage is collected in a separate system, the basements are fitted with an oil collector and with pump.

Gas supply: For the central boiler house, with central gas meter, located on the roof level.

Central heating: There are condensing equipments, which supply the entire building. For independent, regulated heater circuits, radiators and air handling devices. The heating of the office areas are done with hot water heating from the central boiler. The heating is done with floor convectors along the façade, 65/50°C system.

Cooling: With central coolers. The chillers supply the entire building. Regulated cooling circles are built. The general office coolers will be the so called inductive cooling beams. The cooling beams are built together with strip lighting.



## San Elia

*Via Livio Cambi, 1, 20151, Milano, Italy*

In order to reduce the energy consumption of block A, in the first phase of the refurbishment, the efficiency and the flexibility of HVAC system has been improved. The existing chillers have been replaced by three new groups with nominal COP of 6, and by two scroll chillers. Two large farm tanks have been built to store energy.

The two scroll chillers are used to satisfy all the cooling demand of the data center while the cooling overproduction can be stored in one of the two farm tanks and used to supply the cooling demand of the offices. In the last winter, the heat recovered from the condensers of the heat pumps, which serve the data center, has been enough to satisfy the heating demand of block A. Another advantage of the storage system is that it allows the scroll chillers to run continuously during the night, when electricity (in Italy) is cheaper and condensers can work more efficiently. Higher cooling requirements are supplied by the three centrifugal chillers.

At the end of the second phase of the refurbishment, the power plant of block A will be connected to block B in order to satisfy the cooling demand of the building. Moreover the heating demand of block B will be satisfied by the old thermal plant in building A.



### Refurbishment - 2006

*Type of building:*

**Office**

*Area:*

**390.000 m<sup>2</sup>**

*Before refurbishment:*

**103,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**70,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**32%**

*Investment:*

**2.180.000 €**

*Annual savings:*

**505.000 €/yr**



## Refurbishment - 2004

*Type of building:*

**Office**

*Area:*

**20.177 m<sup>2</sup>**

*Before refurbishment:*

**506,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**225,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**56%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Bürohochhaus Hahnstraße

*Hahnstraße 31 – 35, 60528, Frankfurt am Main,  
Germany*

The office building was constructed in 1974. It has one basement and 14 above-ground floor. The building was almost substantially refurbished between 2002 and 2004. It received a completely new building equipment and appliances, a highly insulated facade and a new interior.

Heating: district heating.

Ventilation: ventilation system with heat recovery 75%.

Cooling: Chilled beams.

Building envelope: opaque façade: 10 cm insulation composite system platform roof: 22 cm insulation. Transparent façade: heat and sun protection glass. Windows: heat and sun protection glass.







## UNIQUA Tower

*Untere Donaustrasse 21, 1029, Vienna, Austria*

Building with double glass cladding using geothermal energy for energy supply. With a heat output of 880 kW and a cooling capacity of 620 kW it presents an innovative way in the heat pump sector. The large sized heat pump provides for about one third of thermal requirements and contributes to an environmentally sound operation of the building.

The incidence of daylight is optimal due to the large glazing area. To create the conditions of illumination at the work places in the offices as convenient as possible, shades and sunscreens, as well as poor in reflexion artificial lighting were installed. The windows can be opened if required. This window ventilation is only optimally effective at an outdoor temperature between 5 °C and 25 °C. The basic ventilation operates through out the year. Energy losses due to the glass façade are held very low. A part of the required heat energy is provided by the solar radiation. A further part is supplied by geothermal heat.

To cool the building two chillers and a heat pump are available. The central ventilating system feed the offices with cooled and dehumidified air. A convective cooling ceiling which is free hanging serves for cooling the offices. One third of the Tower heating is provided by the energy piles in the soil (55 slurry walls, 34,5 m deep – 44 km submountain buried absorber pipes). For the heat pump two back coolers were installed on the roof of the tower, to allow the possibility of Free-Cooling and an additional reverse-flow cooling in case of a full energy storage.



**New - 2004**

*Type of building:*

**Office**

*Area:*

**31.244 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

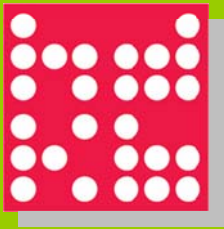
**40%**

*Investment:*

**70 Mio.€**

*Annual savings:*

**n/a**



## Refurbishment

*Type of building:*

**Educational**

*Area:*

**56.348 m<sup>2</sup>**

*Before refurbishment:*

**309,20 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**231,60 kWh/m<sup>2</sup>yr**

*Energy savings:*

**25,1%**

*Investment:*

**1.085.200 €**

*Annual savings:*

**238.500 €/yr**

## Universität der Künste

*Einsteinufer 43-53, 10587, Berlin, Germany*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Refurbishment of the heating system (new pumps, new valves and other fittings has been refurbished); Hydraulic balance of the heating system; integration and adjustment of thermostatic valves on radiators; Installation of a new heating supply circle for the apartments in the buildings; Refurbishment of the heating distribution system; Regulation of the hot water production; Shutting down the hot water circulation in the night; New plan for heating up the entrance hall.

Air conditioning and Ventilation: Optimization of the cooling machine; Refurbishment and regulation of the ventilation system.

Installation of reflectors; Regulation of the lightning devices; Installation of several motion detectors.

Central building control system: Integration of a control system; Optimization of this system; Optimization of the monitoring-system; Installation of several measurement instruments;





## Library

*Livanjska 5, HR 21000, Split, Croatia*

Façade surface is double skin glass façade (distance 80cm). Outer glass pane is single with reflexive coating to minimize sun gains during summer period. Inner glass pane is double with low-e coating. Air is circulating the space between the two glass panes.

Heat energy is produced in heat pumps integrated in air-condition system using exhaust air and air from underground levels. Maximum heating and ventilation capacity is 400 kW.

Cooling energy is supplied by adiabatic process, air-condition integrated mechanical cooling and compact cooling device. Through integrated design concept high percentage of energy recuperation is achieved (80-92%).

CSMS coordinates performance of air-condition system, heat energy production, cooling energy production and individual space regulation. Database is used for performance control, system surveillance and cost analysis.

(In Croatia there are no legal values for primary energy and all calculations and comparisons were made based on heat energy demand.)



**New - 2008**

*Type of building:*

**Educational**

*Area:*

**14.611 m<sup>2</sup>**

*Reference value:*

**52,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**28,50 kWh/m<sup>2</sup>yr**

*Energy savings:*

**46%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Educational**

*Area:*

**1.737 m<sup>2</sup>**

*Before refurbishment:*

**145,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**75,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**48%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Årsta 59:1

*Uppsala, Sweden*

The following changes to the building have been completed:

Improved outer insulation.  $U_{mean} = 0.133 \text{ W / m}^2 \text{ K}$ .

Ventilation is the FTX type with 83 % efficiency and low SFP result.

Insulation: cold spots or deficiencies have been minimized through improved design. Insulation requirements are 0.3 l / s, m<sup>2</sup> at  $\pm 50 \text{ Pa}$  or better.

162 m<sup>2</sup> of solar panels have been installed.

Lighting systems have an automatic turn-off function.



## Autocamp Politin

*Croatia*

During the summer period, all touristic resorts are characterized with high consumption of sanitary hot water (SHW). Of course, it means that the energy used for the sanitary hot water preparation is significant part in total energy consumption.

We decided to use a heat pump (water-water) which uses the waste drain water as a heating source, for preparation of SHW - heat pump which uses the waste drain water as a heating source. This solution has significantly shorter pay back period than the solar system and this system does not need any back up energy source. The heat pump used is 115 kW of heat power. The main system uses condensing potential of the heat pump (115 kW of heat capacity) for SHW preparation. Waste water from the sanitary block is used for the evaporation. The waste sanitary water has sufficient thermal potential and in energy balance gives about 80-90% of energy recovery. In this example it means - for 10 kWh useful heating energy the system takes 8-9 kWh from the waste water. The rest of 1-2 kWh is the energy from fuel or electricity consumption.

For the conclusion, with the heat pump solution we turned the residual energy of waste water into useful heat energy for SHW preparation.

(In Croatia there are no legal values for primary energy and all calculations and comparisons were made based on heat energy demand.)



### Refurbishment - 2006

*Type of building:*

**Hotel**

*Area:*

**n/a**

*Before refurbishment:*

**514.772 kWh/yr**

*Primary energy demand:*

**103.994 kWh/yr**

*Energy savings:*

**80,6%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





**New - 2010**

*Type of building:*

**Office**

*Area:*

**22.116 m<sup>2</sup>**

*Reference value:*

**114,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**74,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**35%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Hekla hus 10

*Sweden*

The buildings and their systems are designed with a structure that is characterized by modularity and flexibility that facilitates adaptation to different plan solutions. Systems and components will be design with regard for life cycle costs and energy effectiveness. Energy use is ensured through energy simulations during the design phase and function controls of more important machines as air handling units.

Heating (heat recovery from the Heat pumps) and cooling is produced in a nearby local energy centre which supplies the building with energy for heating and cooling. A number of Heat pumps are installed in the energy centre. During the really cold days through December to Mars the energy centre uses district heating to take care of the top load. There are large air-handling units equipped with rotary heat exchanger and a pre-heating coil also a cooling coil. The air handling unit together with active air diffusers in the ceiling. Each of the air diffusers has its own control regulator. Ventilation is then demand-controlled (VAV-Variable Air Volume) and several different control options can be utilized. Ventilation system is designed for low velocities and pressure drops minimising the fan electricity.

The energy management system is directly connected to the overall management system.





## Spektern 13 B

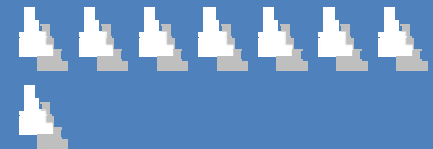
Sweden

The buildings and their systems are designed with a structure that is characterized by modularity and flexibility that facilitates adaptation to different plan solutions. Systems and components will be design with regard for life cycle costs and energy effectiveness. Energy use is ensured through energy simulations during the design phase and function controls of more important machines as air handling units.

Heating is produced in the local energy centre which supplies the building with energy for heating.

There are one large air-handling unit equipped with heat exchangers, heating and cooling. We will improve existing central air handling unit to achieve the highest possible heat exchange. Ventilation is demand-controlled (VAV-Variable Air Volume) and several different control options can be utilized. Ventilation system is designed for low velocities and pressure drops minimizing the fan electricity.

Cooling is produced in the local energy centre which supplies the building with cold water for cooling.



### Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**204,70 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**131,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

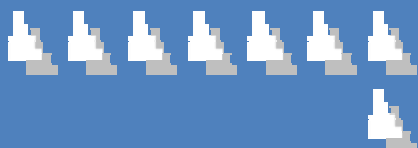
**36%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**24.632 m<sup>2</sup>**

*Reference value:*

**200,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**50,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**75%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Riga 2

*Sweden*

The buildings and their systems are designed with a structure that is characterized by modularity and flexibility that facilitates adaptation to different plan solutions. Systems and components will be design with regard for life cycle costs and energy effectiveness. Energy use is ensured through energy simulations during the design phase and function controls of more important machines as air handling units.

Heating is produced in a nearby local energy centre which supplies the building with energy for heating.

There are large air-handling units equipped with heat exchangers, heating and cooling. The pressure controlled air handling units together with active air diffusers in the ceiling save a lot of energy. Each of the air diffusers has its own control regulator. Ventilation is demand-controlled (VAV-Variable Air Volume) and several different control options can be utilized. Ventilation system is designed for low velocities and pressure drops minimizing the fan electricity. Cooling is produced in cooling machines which supplies the building with cold water for cooling.





## Kista Science Tower

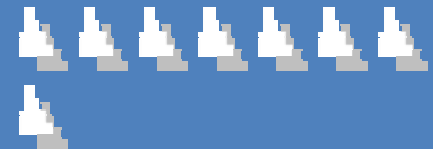
*Sweden*

The construction of Kista Science Tower was completed in 2002. The level of leased area has increased from 87 % in 2007, to 94 % in 2008. At the same time essential energy savings have been realized.

Since mid-2007, a continuous and active work is being performed adapting the distribution of heat, cooling and ventilation to each part's operation. By doing so the energy demands for Kista Science Tower decreased by 30 percent during 2007. The decrease was realized mainly by decreasing the distribution of energy (heating and cooling) and air-flow during nights and weekends.

Another important area of decrease was to customize the heating demand to different parts of the complex, depending of operation. The aim is to deliver an indoor climate as comfortable as possible in the same time as reducing unnecessary usage of energy.

No investments of equipment were required for this decrease.



### Refurbishment - 2007

*Type of building:*

**Office**

*Area:*

**50.000 m<sup>2</sup>**

*Before refurbishment:*

**143,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**94,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**30%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment - 2009

*Type of building:*

**Office**

*Area:*

**n/a**

*Before refurbishment:*

**261,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**100,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**62%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Pennfaktaren 11

*Sweden*

The building is supplied with energy for heating and cooling by the district heating / cooling network. New central for district heating, resulting in more efficient heat exchangers, pumps and control. Facade renovation, including more energy efficient windows, minimizing heat loss in winter and sun radiation loads in summer.

Complete rebuilding of HVAC system, for example new HVAC units with double rotating heat exchangers and evaporative cooling for office areas. For heating and cooling, the building will mainly be supported by air, with variable air volume function. This will result in more efficient operation of HVAC system.

Solar panels, approximately 125 square metres, will be installed.







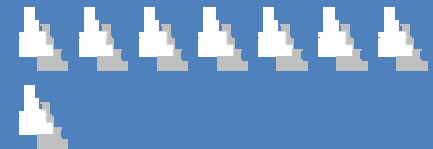
## Kv Skjutsgossen 8

*Sweden*

The house is equipped with heat exchangers which extract heat from the buildings cooling system. District heating is used when the energy extracted from the heat exchangers is not enough.

Cooling is produced in two cooling machines. All the air-handling units are equipped efficient heat recovery. The ventilation in the conference center is demand-controlled (VAV-Variable Air Volume).

Some of the exhaust air from the offices is used to heat the garage.



### Refurbishment - 2008

*Type of building:*

**Office**

*Area:*

**14.260 m<sup>2</sup>**

*Before refurbishment:*

**134,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**80,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**40%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**14.000 m<sup>2</sup>**

*Reference value:*

**100,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**70,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**30%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Tingsrätten Ullevi Park

*Sweden*

Office Ullevi Arena is certified according to BREEAM and Green Building and is developed as an office building with climate-wise solutions including low energy, good material and a comfortable indoor climate.

The building is supplied with district heating and cooling. Ventilation will be provided through both variable air flow systems to the public and with a constant air flow to the office parts.

To help our tenants to save even more energy, we have created a web based tool where you can easily teach you how you can save more energy and reduce carbon dioxide emissions



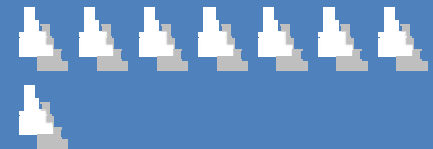


## Ullevifastigheter AB

*Sweden*

Some of the reasons for the building's low energy use is the property's design, double glass facades and efficient recovery of energy. In addition, controlled ventilation for the different needs that exist in the property and thus function differently in offices compared to prison cells.

The building is supplied with district heating and district cooling. Heat is distributed throughout the building via air conditioning and radiators. Cooling is supplied via ventilation air and chilled beams. The building contains one single air handling unit but the distribution of the air is divided into two groups for both supply and exhaust air. One group provides the living unit floors 6-9 while the other group provides floor 0-5, 10 and 11. The ventilation system for floor 6-9 runs continuously while the floors 0-5, 10 and 11 are planned to be in use part of the day. Rooms with variable load are provided with components for variable air flow.



**New - 2010**

*Type of building:*

**Office**

*Area:*

**18.200 m<sup>2</sup>**

*Reference value:*

**125,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**91,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**27%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



**New - 2009**

*Type of building:*

**Health**

*Area:*

**n/a**

*Reference value:*

**108,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**77,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**28,7%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Tehuset

*Sweden*

For this building, energy savings are achieved mainly by implementing a variety of measures such as:

Life cycle cost based selection of systems for lighting and management for lighting. LCC-based selection of windows and climate shield etc.

Optimization of dimension criteria's for pumps and exchangers, which led to a significant reduction of energy use in operating.

Need based air- and fluid flows.

Recycling of cooling energy for hot water.



## Hus N

Sweden

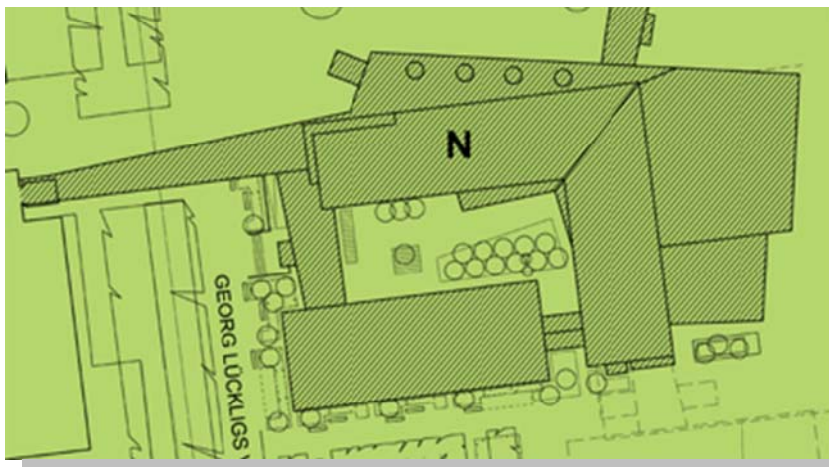
The carrying structure of the Hus N consists of glued laminated timber beams. The façade are wooden stud walls with 215 mm insulation, dressed with wooden panelling. The walls and floor in the basement consists mainly of concrete, with 200 mm insulation.

The building will be heated with a water carried radiator/convector system connected to district heating. The district heating provided from Växjö Energy AB are produced in district heating plants with bio fuel as energy source. They will also connect to available locally produced cooling system, that will be rebuilt and a new refrigeration unit will be installed. A LCC-analysis will be done to optimize the new refrigeration unit.

The ventilation system is exhaust and supply air ventilation with heat recovery (FTX system). It is a VAV-system, with variable flow of supply air, and used as climate control.

The lighting will be regulated both by presence and daylight.

Videums energy policy aims to reduce and in the future, finally stop using electricity as a heat source and to make their energy usage more effective. They want to offer their customers well adapted premises at high standard with minimal environmental effects.



**New - 2010**

*Type of building:*

**Educational**

*Area:*

**6.320 m<sup>2</sup>**

*Reference value:*

**110,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**76,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**31%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





**New - 2009**

*Type of building:*

**Social**

*Area:*

**18.977 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**62,30 kWh/m<sup>2</sup>yr**

*Energy savings:*

**>25%**

*Investment:*

**663.565 €**

*Annual savings:*

**n/a**

## Alexandra Building

*C/ Arcadia, 08206, Sabadell, Spain*

In order to achieve the efficiency level, a number of techniques and technologies are used in combination:

Passive solutions: Ventilated façades and roof: radiation control and easy maintenance; Building location and orientation of all rooms and facilities: windows oriented towards the equator to maximize passive solar gain; Solar protection with graduated/adjustable shades (summer total protection and winter warmth gaining); Building compact design: compact in shape to reduce their surface area.

Energy systems: Central heating system: to optimize real energy demand and introduce efficient equipment.; Heat-Cold radiating floor; Library and social facilities divided in sector areas to guarantee a proper functionality and scheduled consumption; Central energy production with high efficiency geothermic pumps; Photovoltaic Solar system 28kWp and a yearly forecast production of 33.457kWh.; To minimize the total primary energy consumption, low-energy lighting (such as compact fluorescent lamps), high-efficiency electrical appliances LED are normally used, and volumetric sensors have been introduced.





## Viroc Headquarters

*Portugal*

The Viroc headquarters building is a paradigm as far as thermal envelope is concerned. To refurbish such buildings is a hard task in order to obtain comfortable thermal conditions to work or live inside, with low energy consumption. Viroc Company, as manufacturer of VIROC®, has the maximum interest in show to everybody how to improve building thermal insulation envelope, using their material. Considering buildings pattern the replication potential is incredible strong.

Main measures: Install insulation material with 8 cm thickness protected by VIROC® panels; Automatic Lighting control with internal sensors; Natural ventilation with manually controlled apertures in the terrace roof; Insuflation of air pre-cooled (or pre-heated) with underground contact, 10 m length duct; Daily manual registration of energy consumption and automatically registration of electricity consumption each 15 minutes period.



### Refurbishment - 2006

*Type of building:*

**Office**

*Area:*

**500 m<sup>2</sup>**

*Before refurbishment:*

**100,40 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**70,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**30%**

*Investment:*

**20.000 €**

*Annual savings:*

**2.250 €/yr**



**New - 2008**

*Type of building:*

**Office**

*Area:*

**20.400 m<sup>2</sup>**

*Reference value:*

**170,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**89,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**47,6%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Västerport in Stockholm

*Ky. Lustgården 10, Kungsholmen, Stockhom, Sweden*

The building has no radiators, meaning that operation with simultaneous heating and cooling is not possible.

The VAV system uses outdoor air without post-treatment when operated correctly. District heating and district cooling will guarantee supply of heating and cooling to the building. Automatic regulation and control will safeguard functions for heat recycling, cooling and post-heating.

Constant pressure will be maintained for intake and exhaust air.

Control of operational status and alarms can be performed from an external computer/OSM. etc. Regulation for optimal operations can be performed from an external computer/GSM. etc.

Decentralized ventilation (one unit per tenant) will mean that stoppages and maintenance will not affect the entire building. The ventilation system is certified by Eurovent.

Intake equipment, and associated regulation and control, is automatic and tested, SWEGON type E.R.I.C.





## Centrale campus Augustijnslei

*Belgium*

3 reports showed interesting energy saving possibilities including insulation of roofs, placement of condensation boiler, replacement of incandescent lamps with energy saving lamps, a relighting of one workshop space and the installation of an energy monitoring system.



## Huize Goeyers

*Belgium*

The building was constructed according the 'Passive house' concept, thus:

Very good insulation of the building envelope e.g. wall insulation was realised using insulating blocks combined with 11-15 cm high performant insulation material.

Very airtight building envelope e.g. a 'blower door test' indicated  $n_{50}=0,3 \text{ h}^{-1}$  which is significantly better then the already strict passive house target, i.e.  $0,6 \text{ h}^{-1}$ .

Heat recovery with a high efficient heat recovery unit (efficiency 90%) On top of this, fresh air is pre-heated (winter-time) and cooled (summer time) using a ground tube.

### Refurbishment - 2010

New - 2009

*Type of building:*

**Educational**

*Area:*

**7.314 m<sup>2</sup>**

**950 m<sup>2</sup>**

*Before refurbishment:*

**453,00 kWh/m<sup>2</sup>yr**

**151,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**209,00 kWh/m<sup>2</sup>yr**

**113,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**54%**

**25%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**



## Refurbishment - 2009

*Type of building:*

**Office**

*Area:*

**3.500 m<sup>2</sup>**

*Before refurbishment:*

**240,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**104,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**57%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Havsfrun 26

*Stockholm, Sweden*

The building is supplied with district heating and cooling. Ventilation has been exchanged to a rotating heat recovery: due to the fact that the air flow is rather high in the building, the installation has been really successful.

New substation: The heat exchangers were old and the maintenance had been neglected.

Systems have been adjusted to optimize energy use.







## Kindertagesstätte Reggio "Kleiner Raabe"

*Böllberger Weg 180a, 06128 Halle (Saale), Germany*

## Kindertagesstätte Taubenhaus

*Taubenstraße 4, 06110 Halle (Saale), Germany*

In order to achieve the efficiency level, a number of techniques and technologies are used in combination:

Heating: central floor heating; Ventilation: ground collectors (cooling effect in summer); Lighting: fluorescent lighting systems; Building envelope: efficient thermal insulation and building services. Windows: wooden frame windows;  $U = 1,254 \text{ W/m}^2$ .

Use of renewable energies to reduce the energy consumption; reduce of the  $\text{CO}_2$  output and saving of the fossil fuels by alternative heating and lower heat loss of the building envelope.

Geothermal pump with direct evaporation of a liquid refrigerant used in Kindertagesstätte Reggio "Kleiner Raabe", support of heating and water heating by thermal solar collectors in Kindertagesstätte Taubenhaus.

New - 2010

Refurbishment - 2010

Type of building:

**Educational**

Area:

**1.562 m<sup>2</sup>**

**2.228 m<sup>2</sup>**

Reference value:

**328,00 kWh/m<sup>2</sup>yr**

**251,00 kWh/m<sup>2</sup>yr**

Primary energy demand:

**240,00 kWh/m<sup>2</sup>yr**

**177,00 kWh/m<sup>2</sup>yr**

Energy savings:

**27%**

**29,2%**

Investment:

**n/a**

Annual savings:

**n/a**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**12.015 m<sup>2</sup>**

*Reference value:*

**132,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**95,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**28%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Dockum

*Hallenborgs street, Malmo, Sweden*

The façade are wood rule walls dressed with façade brick. The carrying structure is constituted of steel pillars and hdf-beam.

The building is heated with a water carried radiator/ convector radiators connected to district heating. Hot water is prepared with real estate electrical and local storage processor in the office part. Restaurant kitchens are connected to hot waters that are linked to district heating.



## Energy Base building

*Giefinggasse 6, 1210, Vienna, Austria*

Solar energy is used in four different ways, by means of two passive and two active technologies. South-oriented areas can efficiently benefit from passive systems and, thanks to the louvered façade design (series of shading and glass panels), heat gains from direct solar radiation are only permitted in winter. Indeed, shading systems reduce the cooling load in summer season. North-oriented areas also benefit from this passive system since warm air can be generated by means of heat exchangers using the heat produced in south zones. Gains from solar PV: A 400 m<sup>2</sup> photovoltaic system (about 47.5 kW peak) integrated in the south facade provides about 42,000 kWh of solar power per year. Gains from solar cooling: a very innovative and environmentally friendly technology, namely the “Solar cooling” or Desiccant and Evaporative Cooling (DEC-installation), enables to make use of solar energy for air cooling application. The principle is to use a heat source (min. 70 °C) to drive the DEC system. Heat is collected through integrated thermal collectors (285 m<sup>2</sup>) located in the south facade. Cooling and heating applications in summer and winter respectively enable an effective utilization of these collectors over the whole year. The louvered south façade also enables a maximization of power production with PV cells and acts as an effective sun protection device for the adjacent office areas. Another renewable energy source is groundwater. Heat pumps can extract heat from ground water wells for heating applications and the same water can be directly used for free cooling applications. The remaining electricity needs for the operation of the building are met by hydropower generation.



**New - 2008**

*Type of building:*

**Office**

*Area:*

**9.200 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**20 kWh/m<sup>2</sup>yr**

*Energy savings:*

**>25%**

*Investment:*

**14,5 Mio.€**

*Annual savings:*

**n/a**



**New - 2010**

*Type of building:*

**Office**

*Area:*

**3.933 m<sup>2</sup>**

*Reference value:*

**n/a**

*Primary energy demand:*

**n/a**

*Energy savings:*

**40%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

## Avia Line II

*Perintotie 2C, FI 01510, Vantaa, Finland*

In order to achieve the efficiency level, a number of techniques and technologies are used in combination:

U-value improvement, windows 1,40W/m<sup>2</sup>,K - 1,15W/m<sup>2</sup>,K; The value of thermal transmittance (U-value) will improve which reduces energy transmittance true the windows.

Heat recovery yearly efficiency 30% - 70%: Air-condition system is planned and equipments selected so that heat recovery yearly efficiency is much better than required in standard 2009 which means lower energy need.

Air tightness of building will be better than required. This will be fulfilled by better air insulation of joints specially in doors, windows and through the holes. This means lower heat flow of air.

Air-condition system is planned and equipments selected so that total system energy consumption is less than required.





## Paradiset 29

*Solna, Sweden*

In order to achieve the efficiency level, a number of techniques and technologies are used in combination:

District heating and district cooling will guarantee supply of heating and cooling to the building.

Renewable electricity is generated by certified Nordic hydropower.

Automatic regulation and control will safeguard functions for heat recycling, cooling and post-heating.

The use of an energy efficiency and operation follow-up tool to analyze historical data from all systems within the building. The information is presented in traditional and suited reports. The program makes it possible to do various types of calculations of energy consumption and cost and regulate discrepancies.



**New - 2010**

*Type of building:*

**Office**

*Area:*

**24.000 m<sup>2</sup>**

*Reference value:*

**112,80 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**76,70 kWh/m<sup>2</sup>yr**

*Energy savings:*

**32%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**





## Refurbishment - 2010

*Type of building:*

**Office**

*Area:*

**4.783 m<sup>2</sup>**

*Before refurbishment:*

**247,00 kWh/m<sup>2</sup>yr**

*Primary energy demand:*

**176,00 kWh/m<sup>2</sup>yr**

*Energy savings:*

**28,6%**

*Investment:*

**n/a**

*Annual savings:*

**n/a**

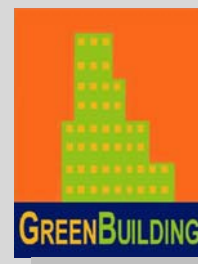
## Stadtfenster Dortmund

*Hansastraße / Bissenkamp 30 / 4, 44137 Dortmund,  
Germany*

Reconstructing the existing Office and Retail Building (constructed in 1952 and 1984) in 2010. Demounting and replacing the 2 attic floors.

It is equipped with a photovoltaic system plant generating 2kWh/m<sup>2</sup>yr and an advanced lighting control, in combination with enhanced insulation. Also most of the windows will get an external sunshade. For air-conditioning, it has a free night ventilation. This results in significantly lower energy consumption and CO<sub>2</sub> emissions than comparable properties. In addition, renewable building materials to use come from sustainable forestry.





## Contact

For more information about the GreenBuilding Programme please contact:

**European Commission,  
Joint Research Centre,  
Institute for Energy  
Renewable Energy Unit**

**Paolo Bertoldi**

TP450, 21020 ISPRA (VA)

Italy

Tel. +39 0332 78 9299

Fax. +39 0332 78 9992

*[paolo.bertoldi@ec.europa.eu](mailto:paolo.bertoldi@ec.europa.eu)*



European Commission

**EUR 24645 EN – Joint Research Centre – Institute for Energy**

Title: The European GreenBuilding Project Catalogue June 2006 – June 2010

Author(s): Paolo Bertoldi, Ana Sanchis Huertas

Luxembourg: Publications Office of the European Union

2011 – 329 pp. – 21,0 x 29,7 cm

EUR – Scientific and Technical Research series – ISSN 1018-5593

ISBN 978-92-79-18789-6

doi:10.2788/65492

**Abstract**

The GreenBuilding Programme is a European Commission voluntary programme through which non-residential building owners and occupiers, being private or public organisations, are aided in improving the energy efficiency and to introduce renewable energy sources into their building stock. Any enterprise, company or organisation (hereinafter defined as “organisation”) planning to contribute to the GreenBuilding Programme objectives can participate.

This report describes some of the projects implemented by GreenBuilding Partners in the period 2005 to June 2010. The projects have been implemented in different types of buildings, such as office buildings, schools, hotels, hospitals, shopping mall, etc. Both new construction and the refurbishment of existing buildings are covered by the report.

Additional information on the goals and results of the GreenBuilding Programme, as well as the current Partners' list and the list of the National Contact Points can be found in the GreenBuilding Programme website at: <http://re.jrc.ec.europa.eu/energyefficiency/greenbuilding/index.htm>.

### **How to obtain EU publications**

Our priced publications are available from EU Bookshop (<http://bookshop.europa.eu>), where you can place an order with the sales agent of your choice.

The Publications Office has a worldwide network of sales agents. You can obtain their contact details by sending a fax to (352) 29 29-42758.

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

